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HANDBOOK

FOR THE

R.M.L. 12·5-INCH 38-TON GUN,

MARKS I AND II.

CASEMATE, DWARF, AND SMALL PORT MOUNTINGS.

LAND SERVICE.

1888.

PRESENTED BY HER BRITANNIC MAJESTY'S GOVERNMENT

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MEMO.

This handbook is corrected up to 7 | 8 | 88. Any alterations which may be suggested should be forwarded to Assistant to Director of Artillery, Woolwich.

R.M.L. 12·5-inch 38-ton Gun, Marks I. and II.

The Guns.

(*List of Changes*, §§ 2792, 4080.)

Plates I and II.

		Mark I.	Mark II.
Material	exterior ..	Wrought iron ..	Ditto.
	tube	Steel	,,
Weight, nominal		38 tons ..	,,
Length	nominal ..	225·5 inches ..	,,
	total	230 inches ..	222·8
Preponderance		Nil	,,
Bore ..	calibre	12·5 inches ..	,,
	length	198 inches ..	,,
	capacity ..	24,578 cub. in. ..	,,
Rifling	system	Woolwich ..	,,
	twist	0 to 1 in 35 ..	Increasing 1 in 438 to 1 in 35.
	grooves: number	9	Ditto.
	grooves: depth ..	0·2 inch	,,
	grooves: width ..	1·5 inches	,,
	lands, width ..	2·863 inches ..	,,
	length	170·5 inches ..	156·87 inches.
Chamber		No enlarged chamber, but end of bore coned ..	Length .. 41·125 inches. Diameter .. 14·0 inches. Capacity .. 6,000 cub. in.
Vent ..	material ..	Hardened copper.	
	position ..	12 in. from bottom of bore at 45° from vertical on right side, or on right or left in turret guns	Axial with safety shutter.

These guns should be examined after firing 32 rounds.

Gun Fittings, Special Implements, and Appurtenances.

Designation.	Detail.		Remarks.
Derrick, loading muzzle ..	bronze, with band, 2 hinge screws, 2 fixing screws with loops, and 2 without	1	only for guns mounted in open works.
Holders, tube	steel, with extractor and spring	3	including 1 spare for Mark II only.
Plate, elevating, Mark I: lower ..	bronze, with pivot "A," keep pin, and 6 fixing screws	1	
Plate, elevating, Mark I: upper ..	,, ,,	1	

Gun Fittings, Special Implements, and Appurtenances—(continued.)

Designation.	Detail.		Remarks.
Plate, elevating, special { lower ..	bronze, with pivot "A," keep pin, and 6 fixing screws	..	a few guns are fitted to take either the Mark I or the special plates, 2 guns at "No man's land" fort, No. 64, and 67, are fitted with these plates.
upper ..	" "	..	
Plate, elevating, Mark II..	bronze, with Mark III, pivot, and keep pin, and 7 fixing screws, for "small port" mounting	1	
Plates, trunnion	iron..	..	2 for mounting and dismounting.
Screws, preserving, { friction tube pin	.. ..	2	Mark I gun only.
lanyard guide	.. ..	1	
plates, elevating	.. ..	12	and " " " when fitted for small port, 7 additional.
shutter frame..	.. ..	6	Mark II gun only.
stud, trunnion	bronze	2	
Screws, fixing { plate, elevating	.. ..	..	1 spare to every 5 screws of same nature.
shutter frame..	.. ..	..	" " " Mark II gun only
Shutter	bronze, with frame and 6 fixing screws, spring retaining wires and 2 fixing screws; guide pulley and axis pin, shutter with hinge bolt and 2 fixing screws, 2 latches, 2 studs, 2 spiral springs, and handle with 2 pins actuating latches, and 2 pivot pins; wheel-lanyard-guide, with pulley, axis pin, hinge bolt, with flat spring and fixing screw, chain and eye bolt; socket, supporting vent, with 4 fixing screws; guide for tube holder; and 1 plug for "electric," and 1 for "friction" firing	1	Mark II guns only.
Springs, latch (spare) ..	steel, spiral, for shutter	..	4 per gun Mark II gun only.
Studs, trunnion	.. ..	..	2 for mounting and dismounting.
Studs, trunnion, "small port"	.. ..	..	2 when mounted, "small port."
Wheel-lanyard-guide (spare)	bronze	..	1 per gun, Mark II gun only.
Washer, vent (spare) ..	copper	..	12 per gun, Mark II gun only.
Vent, axial	steel, with washer, nut, and double key (key in 2 parts)	1	Mark II gun only, 1 spare vent per gun is allowed.

Gun Fittings, Special Implements, and Appurtenances—(continued.)

Designation.	Detail.		Remarks.
	Special Implements.		
Wrenches, holder, tube	iron..	1	Mark II gun only.
Wrenches, nut, vent ..	iron, axial vent	1	„ „
Wrenches, plug, shutter	iron, T-handled	1	„ „
Wrenches, shutter ..	steel, in two parts, for fixing screws of shutter	1	„ „
Wrenches, stud, trunnion	steel, and for preserving screw	1	„ „
	Appurtenances.		
Bit, vent, 36-inch	.. ..	1	Mark II gun only.
Cascable, slinging	iron, removable	..	1 per fort, or work where these guns are mounted. Mark II gun only.
Clamps, tangent sight "A"	bronze	3	1 spare to every 10 guns or less.
Cradle, vent	wood, with acorn guide for inserting axial vent	..	1 per fort or work where these guns are mounted. Mark II gun only.
Drift, vent, 36-inch ..	steel	1	Mark II gun only.
Extractor, tube V.M. ..	steel	2	„ „
Extractor, tube F. special ..	steel, for jammed tubes ..	..	„ „ 1 to 5 guns.
Pivots, elevating, "A" (spare)	.. ..	..	2 to every 10 guns.
Pivots, elevating, Mark III (spare)	steel for Mark II, plate, elevating	..	1 to every 10 guns.
Prickers, vent, 29-inch ..	.. .. ..	..	Mark I gun only.
Punches, vent, 22-inch ..	.. .. ..	..	„ „
Rod, vent, 36-inch ..	steel	1	Mark II gun only.
Rimers, vent, axial ..	bronze	1	„ „ 3 to every 2 guns allowed spare.
Sights, R.M.L., fore, G. ..	.. .. ..	3	1 to every 3 or less number of guns.
Sights, R.M.L., tangent ..	steel	3	1 to every 3 or less number of guns.
Sights, R.M.L., reflecting fore	.. .. ..	2	1 to every 5 or less number of guns (small port mounting only.)
Sights, R.M.L., reflecting hind	steel, with tangent scale, bar, and clamp bracket, with reflector	2	1 glass mirror per gun, and 1 mirror with frame, to every 10 or less number of guns (small port mounting only.)
Wrench, pivot, No. 4 ..	steel, in 2 parts, with tommy	1	Mark I gun only.
Wrench, sight, R.M.L., acorn	steel	1	Mark I gun only. 1 to 10 guns with acorn foresights.

NOTE.—A "hand rifling machine" for repairing slight injuries, burrs, &c., in the bore, and a "Wrench, pivot, No. 1," for removing jammed pivots are supplied for use with these guns.

Axial Vent.

Plates III and IV.

The Mark II gun is axially vented, the cascable being removed from the gun. The vent consists of a steel bolt V containing the vent-channel, and passing through the vent-hole in the metal of the gun. It is mushroom-shaped at the end K in the bore, and at the other end, which is prepared to receive the vent-sealing tube N, it is fitted with an interrupted screw-thread, which engages a cross-handled tube-holder H. This latter holds the head of the tube by means of a spring catch. A key ring L preventsthe bolt from turning round, and the nut M keeps it tightly fixed in the metal of the gun. A copper washer R is provided to seal the junction between the mushroom-head and the bottom of the bore. F is a guide, in a groove in which a projection on the vent-head must fit to ensure that the head is correctly put on. It is fastened to the bronze socket A, which is attached to the gun by fixing screws.

As a guard against accidents arising from defective tubes, a shutter B is hinged on the left of the socket. It is fitted on the right with a hinge- and latch- handle G, by which it can be opened or closed. The shutter also acts as a tell-tale, a raised rim on the inner side preventing it from being shut, except when the cross-handles 0, 0, of the tube-holder are in their proper position, immediately in front of two slots in the rim. The centre of the shutter is prepared to receive octagonal-headed screw-plugs C or D. C is centrally perforated and employed with vent-sealing friction-tubes, the lanyard being led away to the left side of the gun by the pulley on the moveable arm E, and the fixed pulley P. D on the other hand is perfectly plain, and for use with electric tubes, the wires being led to the right side between the shutter and the socket.

Owing to the use of vent-sealing tubes, axial vents generally last in good order for a considerable length of time. The bolts should be removed, examined, and replaced before and after each day's firing. They should be examined for cracks, and all burrs should be removed by filing. They need not be condemned for erosion until the wear is considerable, or until the scoring is approaching the outer surface, or likely to hold smouldering cartridge. The strictest attention must be paid to the nut M, and the washer R. The nut must be tightened up, with the wrench issued for the purpose, before firing, and again after the first round or two, and as often as necessary. The washer must be inspected, and exchanged when defective. It is intended to prevent the escape of powder gas between the vent-bolt and the metal of the gun, and if not carefully attended to the gun will become eroded and require bushing. The vent-hole, therefore, should be examined for burrs, cracks, and erosion.

In order to remove the vent-bolt detach the tube-holder H, take off the socket A, unscrew the nut M, take out the key L, and then push the bolt forward on to the cradle S previously placed in the bore to receive it.

Inserting the bolt is exactly the reverse operation. An acorn guide T is placed in the rear end to guide it into the metal of the gun. Remember to place the copper washer on the bolt before insertion.

The tube-holder is detached from the bolt by giving it a quarter turn to the left, and drawing it out clear of the gun. To fix the tube, place the tube-holder vertically in the left hand, at the same time pressing the spring catch with the left thumb; then place the tube, wire first, into

(*Axial Vent—continued.*)

the holder, and release the spring. To insert the holder, place the feather in line with the groove in the guide F, push it home, and give a quarter turn to the right.

Should any difficulty be found in removing the holder with the fired tube attached, the holder should be removed first, being released from the tube by pressing down the catch, and the tube can then be extracted by application of the special extractor under its head.

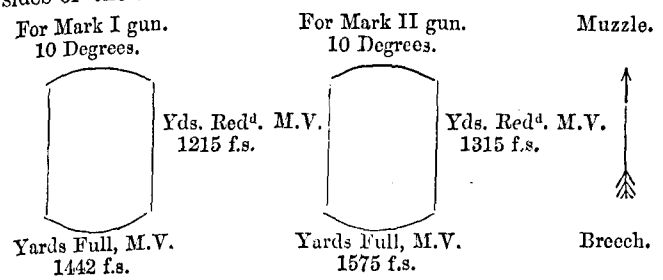
Two holders are issued with each gun, and to save time it is well to use both, the spare one being kept ready with a tube inserted in it.

There being no vent-server with this gun, the holder containing the old tube is not to be removed until the gun has been re-loaded.

Sights.

Three tangent* sights, and three fore-sights, are provided for each gun.

The tangent sights are placed one on each side of the gun, and one as a centre hind-sight. They are graduated up to 10°, and are furnished with deflection leaves giving deflection 2° right and left. The sides of the bar are marked as under:—



The leaves of these sights have the shallow notch 0·06″ deep. The holes in the metal of the gun for the reception of the sights and sockets are bored for some depth and then open to the exterior by a channel sloping downwards towards the rear.

The fore sights are of drop "G" pattern, and consist of a pillar, collar, and socket. A steel acorn apex is screwed into the pillar from which it can be removed by a wrench supplied for that purpose. The socket is permanently fixed in the gun; the pillar and collar each lock into it with a bayonet joint, so that, when once the sight is in its true position, it cannot be removed without first raising the collar and turning the pillar round a quarter of a circle.

Reflecting Sights.

(*List of Changes*, §§ 3120, 4303.)

Plate V.

For guns mounted on small port carriages, in addition to those already described, there are supplied two rows of reflecting sights, each consisting of a fore- and hind-sight.

* These will probably be superseded by steel sights with reversible leaf, giving 3° deflection right and left.

(*Reflecting Sights—continued.*)

Fore-sight.—This is the usual "drop sight" employed with heavy guns; it is fitted in the ordinary way with a gun-metal socket secured in the metal of the chase, at a distance of 30 inches in front of the hind-sight.

Hind-sight.—Consists of a rectangular steel bar of the ordinary section, graduated up to 8 degrees on the rear face, and a gun-metal arm carrying a mirror and sight leaf; this arm slides up and down the steel bar, and is clamped at the necessary elevation by means of a milled headed screw. Its direction is always parallel to the axis of the piece. The sight leaf is capable of giving deflection to the amount of $1\frac{1}{2}°$ right or left. The mirror revolves freely in a horizontal plane, and partially also in a vertical plane, so as to suit the position of the man laying the gun.

A hind-sight is provided for each side of the gun, the two sights being interchangeable. For the reception of the sight bar, a gun-metal socket is fitted into the chase on each side of the axis of the piece, a little in front of the 1 B coil, being inclined at the necessary angle for deviation. In this socket the bar remains fixed while the cross-piece or arm is moved up or down, or clamped at the required elevation.

To use this sight the man laying the piece stands in front of the trunnions, facing the gun, or with his back to the port, according to the adjustment of the mirror; and, having clamped the cross bar at the necessary elevation, lays the gun by traversing and elevating until the object, the notch on to back sight, and the point of the fore-sight are reflected together upon the mirror.

CARRIAGES AND PLATFORMS.

Casemate and Dwarf Mountings.

Carriage, Garrison, R.M.L., Casemate or Dwarf, 6 feet recoil, Mark II.
" " " Casemate, 7 feet recoil, Mark II.
Platform, R.M.L., Casemate, 6 feet recoil, Mark III.
" " " " " Mark III, Special.
" " " 7 feet recoil, Mark III.
" " Dwarf C, Mark III.
" " Dwarf D, Mark II.

Note.—The Mark I pattern of carriage and platform was originally constructed with a compression buffer on the platform, and a cone-clutch on the traversing gear; the alteration of the buffer to one in tension on the carriage, and the substitution of a disc-clutch for the cone-clutch, constitute the Mark II pattern of carriage and platform (§§ 4026, 4098). A Mark III platform (§ 4112) has a larger disc-clutch, but in other respects is identical with Mark II. The Mark III special 6 feet recoil casemate platform has trucks and racers similar to the 7 feet recoil platform. A Mark II carriage is mounted either on a Mark II or Mark III platform.

Carriages.

(*List of Changes*, §§ 3084, 4098, 4613, 5248.)

Plates VI, VII, VIII.

This carriage is of double-plate construction, the brackets being formed of two plates of wrought-iron, rivetted to a frame of cast-iron. They are connected by three transoms, two at the front and one at the rear, and are further strengthened by a pair of knee-stays. The transoms and stays extending below the brackets form a well to the carriage which is completed by the bottom plate and by plates at the sides. The bottom plate does not extend to the rear transom. Its rear edge is strengthened by angle-iron.

On the front transom a block of wood is attached to serve as a buffer block.

Similar carriages are employed as "casemate" and "dwarf," the difference in height being given by the platform.

Carriages for axial-vented guns have the rear transom lowered at the centre, and the upper edge strengthened by angle-iron, to allow of the shutter being opened at extreme elevation.

The carriage and casemate platform are intended to fire over a 3 feet 2 inch genouillère; the height of the axis of the gun above the top surface of the racer being 4 feet 11½ inches. They are arranged for either 6 feet or 7 feet recoil.

The carriage and dwarf platform are arranged for 6 feet recoil only, and allow of a fire over a 4 feet 3 inch parapet; the axis of the gun being 6 feet 0½ inch above the top surface of the racer, at the outer edge, the racer being coned.

The carriage allows of 10° elevation and 5° depression. The carriage has attached to it a tension hydraulic buffer, and this buffer being constructed either to allow of a nominal 6 feet or 7 feet recoil, the carriage when so fitted is only suitable for a corresponding platform.

The parts of the carriage are:—

Elevating gear.
Nipping gear.
Hydraulic buffer.
Preventor gear.
Compressor stop plates.
Clip plates.
Two metal front rollers with axles.
Two metal rear rollers with eccentric shaft.
Rear roller jack.
Capsquares.
Rear steps.

Elevating Gear.

This is spur-wheel gear, and consists of a train of wrought-iron spur wheels and steel pinions on the right bracket of the carriage, worked by a hand-wheel on the outside of the bracket. The elevating arc is of steel, and is rigidly attached to the gun by means of pivot-pieces at top and bottom. Attached to a bearing on the bracket is a

clamping arrangement, consisting of a bow or cramp, two friction pieces, and a screw with lever handle. The screw on being tightened presses the friction pieces against the sides of the arc and clamps it. The outside of the arc is graduated. The graduations consist of alternate black and white spaces, each of which is numbered and represents an angle of 10 minutes, the graduations being inclined upwards for elevation and downwards for depression. The spaces are subdivided across the arc, so that by means of a pointer, fixed on the bracket of the clamp, readings of two minutes can be obtained. The edge of the pointer is radial with the axis of the trunnions, and coincides with the zero of the arc when the gun is horizontal. The gain of power in elevating is 65·7 to 1.

Nipping Gear

Is used to connect the carriage with the running-back chains of the platform. It consists of a sprocket plate (or plate with projecting teeth) on each side, sliding through a slot in the bottom of the carriage. The two sprocket plates are joined by links to rocking levers, which are keyed on a short cross shaft, supported in bearings on the bottom plate. A counterweight, on the right rocking lever, raises the plates from the chains and disconnects the gear. The lever, on the left side, is connected by a link with an eccentric, worked by a lever handle outside the left bracket of the carriage. A stud on this handle catching in a pawl on the carriage, keeps the gear disconnected. The running-back chains pass through brackets beneath the carriage, which hold them up to the sprocket plates, when the latter are forced down.

Hydraulic Buffer.

A tension buffer is used to reduce the recoil. The cylinder is fixed to the bottom plate of the carriage, and the piston-rod attached to the front of the platform. When the carriage is run up, the piston is at the rear of the cylinder and the oil in front of it. On recoil the cylinder moving with the carriage and the piston remaining stationary, the resistance of the oil to the motion checks the recoil. The oil passes from the front to the rear of the piston through holes in it, the size of which is fixed by the estimated velocity of recoil. The larger the charge the smaller the holes should be.

The principal parts of the buffer are:—

* A wrought-iron cylinder.
A metal bracket, forming the front cap.
A wrought-iron rear cap.
A wrought-iron piston.
A wrought-iron piston-rod with nuts.

The cylinder—for 6 feet recoil is 6 feet 6 inches, and for 7 feet recoil 7 feet 3 inches long. In either case it is about $\frac{3}{4}$ inch thick and 7·56† inches internal diameter. The cap is screwed upon the rear end, while the metal bracket which forms the front cap is screwed upon the front, and secured with a set screw. This bracket, by which the buffer-cylinder is secured to the carriage, is fitted with a packing gland,

* In future manufacture, the cylinder will be of steel.

which, in addition to the cotton packing, has a cup-leather, kept in position by a gun-metal ring. The filling-hole is at the rear of the cylinder on the upper surface, and is tightly closed by an iron screw-plug with leather washer. The draw-off valve is at the front of the buffer. The piston is 7·54† inches in diameter and has four holes in it of the sizes given below :—

	160 lb. P.² 165 lb. Prism.	190 lb. Prism.
Casemate, 6 feet recoil	·44	·43
Dwarf C and D	·44	—
Casemate, 7 feet recoil	—	·45

The piston is screwed on the piston-rod and secured by a set screw. The rod, 3·5 inches diameter, is fitted at the front with two nuts, one for each side of the transom when it is secured to the front of the platform. For screwing on the nut of the piston rod, a special spanner is supplied, "Spanner, hydraulic buffer, No. 2"; also, for opening or closing the draw-off valve and the filling-hole plug, a "Spanner, hydraulic buffer, No. 6," is supplied.

Preventor Gear

Is used to control the carriage when running up. It consists of a rocking lever, pivoted to the rear of the second transom and passing through the bottom plate, which, at its lowest extremity, has hinged to it a small compressor-plate. This plate grips the preventor-bar of the platform, between it and a fixed piece on the bottom plate of the carriage. The upper arm of the rocking lever is forked to suit a nut on a short screw-shaft, worked by a handle on the outside of the right bracket. To adjust the amount of compression when necessary the screw-shaft has a collar with teeth, cut on its outer face, which fit corresponding teeth on the boss of the handle. The lever handle may be worked by hand; but to ensure its acting automatically there is a projection on it, which engages with a tripper on the platform when the carriage runs up.

Compressor Stop Plates

Are two plates suspended under the carriage, which, becoming jammed between the plates of the compressor stop on the platform, prevent the carriage running up after recoil.

Running-up Gear

Consists of two front rollers, two rear rollers on an eccentric shaft, and the hydraulic rear-roller jack. The front roller axles are held in metal eccentric bushes on the carriage, so that the rollers can be

† These are the mean diameters, but in future manufacture the respective diameters of the cylinder and piston will be 7·568 inches and 7·56 inches. In the case of existing mountings for axial-vented guns, the pistons will be altered to give this clearance.

adjusted in their bearings when necessary. The rear-rollers run on an eccentric shaft, supported in bearings in each bracket. The shaft is fitted with a crank, to which the ram of the hydraulic jack is attached.

The jack used is the rear-roller jack common to 35- and 38-ton, and some naval carriages. It is marked "left hand."

NOTE.—"Right hand" are only used in right hand turret carriages.

The jack is attached to the left side of the carriage by a trunnion, forming part of the reservoir, which is held in a metal bearing on the top of the carriage bracket, the ram being attached by a pin to the crank on the eccentric shaft. The spindle of the pump passes through the end of the trunnion, where the lever handle fits on it. The pump is double acting, taking in fluid at the upstroke alone, when the handle is forced to the front. In the down stroke, half the fluid is forced on to the ram, the other half passing by a passage to the top of the plunger, from whence, in the following up stroke, it is also forced on to the ram.

The release valve is internal, and is brought into action by pressing the handle to the rear beyond the ordinary stroke.

Care must be taken in raising the carriage on its rollers, not to carry the lever too far to the rear, or lowering will commence.

A pointer is attached to the end of the rear roller eccentric shaft, on the left side, to indicate the extreme limit to which the jack should be pumped up.

NOTE.—In some of the jacks first issued the release valve was external.

Capsquares.

The capsquares are interchangeable and reversible on either side of the carriage. Each is secured by two French keys attached to the carriage.

Clip Plates.

These prevent the carriage jumping when the gun is fired. One is fitted on each side near the front, passing through a slot in the angle plates of the bottom of the carriage, and projecting under the top flange of the platform. Each clip is secured by one bolt passing through it, and the bottom of the carriage. It is necessary to see that these are attached before the gun is fired. They must be taken off before the carriage is dismounted.

Rear Steps.

These are small steps on the rear transoms of the carriage, with counterweights to cause them to remain folded against the transoms when out of use.

Platforms.

(*List of Changes*, §§ 3098, 3099, 4026, 4613, 5248.)

Plates VI, VII, VIII, IX.

The various platforms are of wrought iron, with girder sides, "fish bellied" in form.

For 6 feet recoil the platforms are 15 feet 6 inches long; and for 7 feet recoil, 16 feet 6 inches long, with a slope of 4°.

The terms 6 feet and 7 feet recoil are nominal only, and are used to designate the two descriptions of platform. The recoils are as shown in the following table:—

Nominal.	Recoil.		Protrusion of face of muzzle beyond pivot, front buffers compressed 1·25".	
	With front and rear buffers and spindles removed.	Buffer stops in contact only, and not compressed.		
	ft. ins.	ft. ins.	ft. ins.	
Casemate, 6 feet recoil ..	6 2	5 9·5	2 0	
Dwarf C " " ..	6 2	5 9·5	16 8·7	
Dwarf D " " ..	6 2	5 9·5	19 3·45	
Casemate, 7 feet recoil ..	7 0	6 7·5	2 0	

As the carriage in running up will compress the front buffers about 1·25 inches, the actual recoil of a carriage on a 6 feet platform should not exceed 5 feet $10\frac{3}{4}$ inches, when the rear stops will be touched but not compressed; that on a 7 feet recoil platform should not exceed 6 feet $8\frac{3}{4}$ inches.

The sides are connected by five transoms, a front top plate, and a rear bottom plate. Truck plates are fixed under the sides to which the flanges for the trucks are bolted. The front truck plate is bent downwards, to clear the hydraulic buffer, and its rear edge is strengthened by angle-iron.

The second transom near the front of the platform is strengthened by a plate, with packing piece and two knees, the latter rivetted to them and the front truck plate. A hole is drilled through the transom and plate, for the piston rod of the hydraulic buffer.

The front part of the piston rod is supported by a steel spiral spring, to relieve the packing in the cap of the cylinder of a strain, which caused it to wear unevenly. The spring is contained in a metal box, which is attached to the platform by $\frac{3}{4}$" bolts.

On Dwarf "C" platforms a pivot plate is secured to the third and fourth transoms; on Dwarf "D" to the fourth transom and rear truck plate.

The parts of the platform are—

Two front trucks.
Two rear trucks.
Two side steps (Dwarf only).
Hand post and sighting steps.
Foot board.
Compressor stop.

(*Platforms, Casemate and Dwarf—continued.*)

Preventor bar.
Front buffer stop (with six spindles).
Two rear buffer stops.
Traversing gear.
Running back gear.
Two snatch blocks.
Traversing pointer.
Spring supporting piston rod.

Trucks.

The front trucks, which have two flanges, and the rear trucks, which have one only, are of steel bushed with gun-metal. They are coned to the angle due to their diameter and distance from the pivot, except in the case of the rear trucks of the casemate platforms, 6 and 7 feet recoil, which are cylindrical. The truck axles are secured in position by a screwed nut and pin (formerly by a collar and pin).

Diameter of trucks over flanges:—

	Front.	Rear.
Casemate, 6 and 7 feet recoil ..	13 inches.	18 inches.
Dwarf "C" „ „	24 „	24 „
Dwarf "D" „ „	24 „	18 „

Traversing and Running Back Gear.

The traversing and running back gear is worked by the same horizontal shaft, under the rear of the platform, which is set in motion by two winch handles working within the length of platform. This shaft has two pinions riding loosely upon it, a bevel pinion for traversing gear, and a spur pinion for the running-back gear. By means of a double clutch, either pinion is made to revolve with the shaft. For traversing, the bevel pinion is connected with a longitudinal shaft, having on it a pinion of metal or cast iron, which gears into a cast-iron rack, let into the floor of the work.* For running back, the spur pinion gears into a spur wheel on another cross shaft. This shaft has two sprocket wheels, with teeth that fit into endless chains, one at each side of the platform. The chains to which the carriage can be attached when necessary, at the front pass over plain wheels in adjusting forks, the latter being held in brackets, secured under the front truck plates of the platform.

For adjusting the forks, and tightening the chains, a special spanner is supplied. "Spanner, socket, tightening chain with tommy," and a "turnscrew, connecting chain," is used for uniting the chains.

Clutch.

The double clutch consists of a series of discs or plates on the shaft, alternately of steel and gun-metal. The former, circular in shape, revolve with the shaft loosely inside recesses in the pinions; the

* In Dwarf "C" and casemate platforms the racks and traversing pinions are at the front of the longitudinal shaft; in Dwarf "D" the pinion is at the rear of this shaft, which has another shaft below it, on which there is an intermediate pinion in gear with the rack, which is laid behind the rear racer.

In certain casemate platforms, 7 feet recoil, at Malta, the rack is raised above the floor of the work, and the traversing gear modified accordingly.

(Platforms, Casemate and Dwarf—continued.)

latter are octagonal or of some similar form, so as to fit the recesses in the pinions, but ride loosely on the shaft.

By means of the clutch lever, the plates in either pinion are forced together, when the friction between them gives motion to the pinion required.

The clutch lever, pivoted at the rear, is moved by a hand-wheel on the left side of the platform, by means of a screw shaft, with a nut in the forked end of the front of the lever.

The clutches are similar for all platforms, varying chiefly in the diameter and number of plates.

They are of the following patterns :—

Casemate, 7 feet and 6 feet recoil, Mark II, §4026, List of changes.
Casemate, 7 feet and 6 feet recoil, Mark III, §4112, List of changes.
Dwarf "C" and "D" Mark II } Not published in
Dwarf "C" and "D" Mark III } List of changes.

Indicator.

On the screw shaft behind the hand wheel is an indicator. This consists of a disc with a spiral groove on its face, in which travels a pointer, sliding in a bracket on the side of the platform. The bracket is marked with the letters R. O. T., respectively for "running back," "out of gear," and "traversing." When the hand wheel is turned to the left (or towards the front of the platform) the spiral groove in the disc, as it revolves with hand wheel, lowers the pointer towards the position marked T, which shows that the gear is in readiness for traversing.

N.B.—Special clutch gear:—In three platforms, 6 feet recoil, at Malta, the traversing and running back gear differs from that described above only in the clutch.

In each of these, the bevel and spur pinions on the shaft for traversing and running back respectively, are moved themselves by two forked levers pivoted under the rear of the platform. The lever acting on the bevel pinion (for traversing) is prolonged and formed into a handle, to work at the rear of the platform, and is fitted with a guide and pin to secure it in the position required. The other lever acting on the spur pinion is connected to the first one by a rod which has a short slot at one end, so that one pinion may be fully out of gear before the slot which passes over a stud causes the lever of the other to move.

These platforms, originally intended for 35-ton guns, have no indicator.

Side Steps.

On the Dwarf "C" and "D" only, a removable wood step is suspended by hooks on each side, to staples bolted to the girder sides.

Posts, hand, and steps, sighting.

(List of Changes, § 5248.)

Plate XIII.

All platforms mounted on sea fronts, will be fitted with a steel post and three wood steps, to facilitate firing at moving objects. These steps will form a standing place for the No. 1, where he will be safe

during the recoil of the gun and carriage, and from which he can look over the sights and give the word of command "fire" at the right moment.

The two top steps are for use in laying the gun, the lower one to facilitate mounting on to the platform.

NOTE.—These fittings will not be suitable for platforms with rear traversing gear, or where the clearance between the rear of the platform and the piers is very limited.

All demands must specify the nature of the platform for which the fittings are required, and the minimum distance between the rear of the platform and the work in which it is mounted, in order that suitable fittings may be supplied.

Compressor Stop.

This consists of two plates, besides the preventor bar, an adjusting screw, and a compressor screw, with lever and catch on the right side of the platform. It is fixed on the rear truck plate of the platform. It comes into action when the carriage has recoiled 5 feet 2 inches for the 6 feet recoil, and 6 feet 2 inches for the 7 feet recoil, by jamming the plates hanging under the carriage, and preventing the carriage running up after recoil. (*See* Carriage.)

Preventor Bar.

The rear end of this bar lies between, and forms one of the compressor stop plates; the front end is secured over the front truck plate. A tripper is attached to the right girder on the outside, to bring the gear into action automatically. (*See* Preventor Gear on Carriage.)

Front Buffer Stop.

This is fixed at the front of the platform to prevent any injury to the carriage or platform in running up. It consists of an angle iron secured to the front top plate, a block of wood secured to the angle iron, and six indiarubber rings with wrought iron spindles and split keys.

Rear Buffer Stops.

A rear buffer stop is fixed inside each girder side, near the rear, in such a position as to prevent any injury to the top or front of the hydraulic buffer, or to the piston on recoil. Each consists of a powerful bracket fixed to the platform, to which is attached one ring of indiarubber round a spindle, secured in the bracket by a split key.

Platforms, 7 feet recoil, mounted on turntables as at Gibraltar, are fitted with a special rear buffer stop in the centre of the platform, with a removable block at the rear; to allow the muzzle of the gun to pass the work, when moved on the turntable from one port to the other.

(Platforms, Casemate and Dwarf—continued.)

Snatch Blocks.

One is fixed on each side of the platform, near the front, to lead the fall of the loading tackle in the direction required. It is attached by means of a shackle joint, with nut and pin to a bracket secured to the outer flange of the girder.

Grease Box.

A box, tin, grease, half round, 3 lbs., is attached by a leather strap on the left side, near the front of the platform, to contain grease for lubricating projectiles.

Racers.

Are of steel, and, with the exception of "A" pivot rear racers, are bevelled at the upper surface to suit the trucks. In section, solid without flanges, they are tapered towards the top, so as to allow the trucks to revolve freely without grinding.

The radii of the racers are as follows:—

	Front.	Centre.	Rear.
Pivot A, 6 feet recoil ..	10 ft. 2 ins.	..	20 ft. 2 ins.*
„ A, 7 „ ..	10 „ 2 „	..	21 „ 2 „
„ C (centre) ..	..	5 ft. 8 ins.	..
„ D	8 ft. 0 ins.	..	3 ft. 8 ins.

NOTE.—For a platform mounted on a turntable, as at Gibraltar, Malta, &c., the part of the rear racer fixed on the turntable is only 3 inches deep, instead of 4·5 inches.

Stops.

The stops are of wrought iron, and are fixed in the masonry at the side of the racer, projecting $1\frac{1}{8}$ inch above the sinking for the flange of the truck.

Traversing Pointer

Is of wrought iron, attached beneath the platform on the right side, and points to a graduated metal arc for traversing, let into the floor of the work.

In works with turntables, two pointers are fitted, one to each side of the platform. That on the right side is of the usual pattern, and is stamped "left port," the other on the left side is of special pattern, and stamped "right port."

Traversing Arc.

The arc is of metal, and graduated to degrees and quarters.

A later pattern traversing arc has been approved for new works, and renewals of complete arcs when required. This arc is made in two sections, with the graduations on one section and the figures on the other.

* The 6 feet recoil platforms, Mark III. special, for "Horse Sand" and "No Man's Land" Forts have the rear racers 21 feet 2 inches radius.

(*Platforms, Casemate and Dwarf—continued.*)

In works with turntables, two graduated arcs are let into the floor of the work, one for the "left port" of service pattern, radius to centre of arc 19 feet 4·25 inches, and one for the "right port," radius to centre of arc 19 feet 5·75 inches.

Weight.

Carriage, 12·5-inch, 38-ton, Mark II. ..	6 feet recoil,	$122\frac{1}{4}$ cwt.
" " " " ..	7 " "	$123\frac{1}{2}$ "
Platform, 12·5-inch, 38-ton, Marks II. and III.	6 " "	$162\frac{1}{4}$ "
" " " " "	7 " "	$163\frac{1}{4}$ "
" " special, Mark III. ..	6 " "	$162\frac{3}{4}$ "
" " Dwarf "C," Marks II. and III. ..	.. ..	$188\frac{1}{4}$ "
" " " "D," Mark II.	.. ..	$184\frac{1}{4}$ "

Small-port Mountings.

Carriage, Garrison, R.M.L., Small-port, 6 feet recoil, Mark I.
Carriage, Garrison, R.M.L., Small-port, 7 feet recoil, Mark I.
Platform, R.M.L., Small-port, 6 feet recoil, Marks II. and III.
Platform, R.M.L., Small-port, 7 feet recoil, Mark I.

These mountings are designed, to enable the gun to be fired through a small port, with a greater elevation and depression than would be obtainable by the ordinary method of mounting.

To obtain 7° elevation, and 4° depression with the small-port, a fall or rise of 14 inches can be given to the trunnions of the gun, which are supported in blocks, movable vertically in slots in the carriage.

Height to axis of gun } 4′ 7·5″ at lowest position.
above top of racers } 5′ 9·5″ at highest position in the carriage.

The 6 feet recoil carriage and platform has been mounted at Plymouth Breakwater Fort, and Fort Cunningham, Bermuda.

The 7 feet recoil carriage and platform has been mounted at Fort Delimara, Malta.

The former are fitted with two compression buffers, and the latter with two tension buffers; the carriages in other respects are the same.

		6 feet recoil.	7 feet recoil.
Weight of	Carriage ..	$193\frac{3}{4}$ cwt.	$206\frac{3}{4}$ cwt.
	Platform ..	$169\frac{1}{4}$ "	150 "

Carriages.

(*List of Changes*, §§ 3836, 4253.)

Plates X, XI, XII.

The carriage is of double plate construction, the brackets being formed of two plates of wrought iron rivetted to a framework of cast iron. The brackets are connected by three transoms, two near the front, and one near the rear. The transoms and bottom plate are arched downwards, instead of forming a well as in the 38-ton casemate and dwarf. The bottom plate is secured to the brackets by angle irons.

(*Carriages, Small-port—continued.*)

In each bracket there is a recess for a movable trunnion block, which serves as a bearing for the gun, and is arranged to slide vertically, when the gun is raised or lowered by the hydraulic lift. Each bracket is strengthened on the exterior at the recess by a plate and arched forging rivetted to the frame. The plate has a slot, through which projects a stud fixed on the trunnion of the gun.

To prevent seizure between the carriage and platform, a metal plate is attached to the bottom of each bracket.

A recess is formed through the front transom and in the bottom plate between the front and second transoms, for the hydraulic lift. Between the two transoms are plates in which are grooves supporting the lift. The opening in the front transom allows the lift to be readily removed with the gun mounted. It is covered by a detached plate, secured when in position by six bolts and keys.

A small wood step, 15 inches by 9 inches, is attached to the right bracket of the carriage.

The parts of the carriage are—

Two trunnion blocks.
Hydraulic lift.
Following-up gear.
Elevating gear.
Nipping gear
Two tension hydraulic buffers (on 7 feet recoil carriages only).
Preventor gear.
Two metal front rollers with axles.
Two metal rear rollers with eccentric shaft.
Rear roller jack.
Clip plates.
Wood step.

Hydraulic Lift.

Plate XII.

The hydraulic lift consists of a ram and a cylinder, the latter formed in one casting with the reservoir, which, placed to the front of it, contains the pump. The top of the ram has a cradle jointed to it, which, when the lift is in action, adjusts itself to the gun, and lifts it with the trunnion blocks of the carriage. The lift, placed centrally in the carriage, is supported by projections cast on it, and can be removed from the carriage, when required, without dismounting the gun, to facilitate which a plate is provided on the platform.

The pump is double-acting, taking in fluid only at the up-stroke of the plunger; at the down stroke, half the fluid is forced under the ram, the other half passing by a passage to the top of the plunger, from which, in the following-up stroke, it is also forced under the ram. The stem of the release valve, which closes a passage in the plunger, projects slightly beyond the face of the upper part of the latter, a groove being cut in the plunger guide to clear the release valve while pumping. To bring the release valve into action, the plunger is drawn out beyond the usual stroke, and the stem, meeting the inclined end of the groove, opens the valve, and releases the pressure.

The pump is worked on each side by a double-ended lever, or handle, outside the carriage bracket, connected to the pump spindle by a short horizontal shaft, with a socket end to fit on the spindle and

prolong it through the carriage bracket. The length of the up-stroke of the plunger is regulated by a jointed stock on the carriage, which must be folded back to clear the lever when it is required to lower the ram.

To show the height of the gun above its lowest position, and the elevation or depression then obtainable, an index plate is fixed outside each carriage bracket at the sides of the slot for the trunnion stud of the gun, which is read by a pointer, or reader, fixed on the trunnion stud; on one side of the index is shown the height of the gun in inches, and on the other the corresponding amount of elevation or depression the port will allow.

NOTE.—The method of packing the pump plunger differs in the lifts. In those for the 7 feet recoil carriages (and the most recent 6 feet recoil) the end of the plunger has a recess turned on it, in which is inserted a long strip of leather to form the packing. In the earliest of the 6 feet recoil, the end of the plunger is removable, and the packing consists of leather collars.

Following-up Gear.

Plate XII.

Consists of a screw placed vertically under each trunnion block, raised or lowered by a nut, the exterior of which forms a horizontal worm wheel, driven by a worm shaft on the inside of each bracket. Each shaft extends to the rear of the carriage, and is there connected by bevel wheels to a cross-shaft worked by winch handles. This gear is not of sufficient power to raise the gun, but is for supporting the gun when fired.

To show the position of the screws, an index plate is fixed on the left bracket of the carriage, and a pointer or reader is connected to and moved by the following-up screws.

Elevating Gear.

Plate XII.

The elevating gear is special. It consists of a straight rack, working between vertical guides, inside the right bracket of the carriage. This rack is slotted lengthwise, and in the slot slides a nut, which is attached to the pivot piece on the gun by a short movable link.

For giving elevation, the rack, which has teeth on its rear edge, is moved by a pinion, set in motion by a hand wheel through a train of spur wheels and pinions on the outside of the bracket; the nut then moving as part of the rack. This portion of the gear has a clamping arrangement; consisting of a cone, secured to the outside of the carriage bracket, and fitting into a recess on the spur wheel which is on the elevating spindle. This wheel is forced on the cone by a lever handle, which has a portion of a screw thread on it, intended to jam against a corresponding portion attached to the end of the elevating spindle. Adjustment of this jamming arrangement is made when required by a screw in the end of the elevating spindle.

To suit the varying position of the trunnions, as the gun is raised or lowered by the hydraulic lift, the nut in the rack is made to shift its position up or down in the slot. This is arranged by a screw passing

through the nut, and hold in bearings at the top and bottom of the rack. At the bottom the screw is secured by a nut, with leather rings, and parting plates to diminish the shock on discharge. Above the rack the screw is continued as a plain spindle, which passes through a bevel wheel, placed above the carriage bracket, which gears with another on a short horizontal shaft, moved by a second or upper hand wheel. The connection of the screw spindle with the bevel wheel is made by a long slot in the former, and a feather in the latter, so that the spindle may slip up and down through the wheel as the rack is moved, but must turn with it. When the upper hand wheel is turned, it causes the screw to revolve, and consequently the nut (carrying with it the gun) to slide up or down in the slot in the rack.

On this screw spindle, below, but connected with the bevel wheel, is a metal spur wheel which gears with a spur pinion on a parallel vertical screw to the rear of the rack. This screw, by a nut working on it, carries a metal scale plate graduated in degrees with intervals of 10 minutes from 7° elevation to 4° depression. A vernier, on a metal plate is attached to the nut, which is linked to the gun, for reading this scale. This vernier is graduated with ten divisions for elevation, and the same for depression, so that the scale can be read to one minute. There is also a vertical inch scale reading 14 inches, fixed to the carriage at the rear of the scale plate, read by an arrow-head, opposite the zero on the rear edge of the latter. When this arrow points to the same height on the inch scale, as the trunnion arrow-head does on its index plate, the quadrant elevation or depression of the gun can be read by means of the vernier.

The gear is arranged so that, by turning the upper hand wheel, the scale plate and vernier may move at the same rate and follow the lift of the gun. To prevent irregularity in this movement of the scales, the pinion of the scale plate screw is made in two parts; the upper with a recess, the lower with a friction cone, which are adjusted by a small nut on the end of the screw. The teeth of the upper part press against one side, those of the lower against the opposite side of the teeth of the spur wheel, so that play between wheel and pinion may be prevented. The nut of the scale plate itself, is also in two parts, kept in adjustment by two screws, to prevent any play between the threads of the screw and nut.

Nipping Gear

Is used to connect the carriage with the running-back chains on the platform.

It consists of a sprocket plate (or plate with projecting teeth) on each side, sliding through a slot in the bottom of the carriage. Each sprocket plate is raised or lowered by cross shafts, to which it is connected by a crank and links. The cross shafts, inclined downwards to suit the curved bottom plate, are connected in the middle by segments of bevel wheels, so as to move together; the shaft on the left side being worked by a lever handle on the outside of the carriage bracket. This handle has a counterweight on it, and has a stud, which engages in a pawl, on the carriage, to keep the gear disconnected.

A lanyard, for raising the lever handle, is attached to a loop at the end, and passes over a sheave attached to the carriage.

The running-back chains pass through brackets beneath the carriage which hold them up to the sprocket plates when the latter are forced down.

(Carriages, Small-port—continued.)

Hydraulic Buffers (7 feet recoil only).

Two tension buffers are attached to the carriage on 7 feet recoil mountings. On 6 feet recoil carriages brackets are attached for the piston-rods of two compression buffers (for description of these see Platform).

The cylinders, fixed to the bottom plate of the carriage near the girder sides of the platform, are connected by a copper pipe near the front, to equalise the pressure during recoil. The piston-rods are attached to the front of the platform. When the carriage is run up, the pistons at the rear of the cylinder have the oil in front of them. On recoil, the cylinders moving with the carriage, while the pistons remain stationary, the resistance of the oil to the motion checks the recoil. The oil passes from the front to the rear of the pistons through holes in them, the size of which is fixed by the estimated velocity of recoil. The larger the charge the smaller the holes should be.

The principal parts of each buffer are—

*A wrought-iron cylinder.
A metal bracket forming the front cap.
A wrought-iron rear cap.
A connecting pipe.
A wrought-iron solid piston and rod with nuts.

The cylinder is 7 feet 3·125 inches long, about 1 inch thick, and 6·06 inches internal diameter.

The cap is screwed upon the rear end, while the metal bracket, which forms the front cap, is screwed upon the front, and secured by a set screw. This bracket, by which the buffer cylinder is secured to the carriage, is fitted with a packing gland, which, in addition to the cotton packing, has a U-shaped leather, kept in position by a metal ring, and in form by another metal ring. The filling hole, at the rear of the cylinder on the upper surface, is tightly closed by an iron screw plug with leather washer. The draw-off cock is in the front cap of the buffer. The piston is 6·04 inches in diameter, and has four holes ·5 inch diameter. The piston forms part of the piston-rod. The latter, 2·5 inches diameter, is fitted at the front with two nuts, one for each side of the transom, when it is secured to the front of the platform. In platforms altered to allow 3 inches more recoil the front nuts project that distance beyond the front transom, allowing the buffers a slip of 3 inches.

Preventor Gear.

Plate XII.

Is used to control the carriage when running up. It consists of a rocking lever, pivoted to brackets on the bottom plate, in rear of the second transom, and passing through an opening in that plate. The rocking lever has at its lower extremity hinged to it a small compressor plate. This plate grips the preventor bar of the platform between it, and a fixed piece under the bottom plate of the carriage. The upper arm of the rocking lever is connected by a link on either side, with the trunnions of a nut on a short screw shaft, worked by a

* In future manufacture, this will be of steel.

handle on the outside of the right bracket. To regulate the amount of compression as required, the screw shaft has a collar with teeth cut on its outer face, which fit corresponding teeth on the boss of the handle. The lever may be worked by hand, but to ensure its working automatically, there is a projection on it, which engages with a tripper on the platform, when the carriage runs up.

Running-up Gear

Consists of two front rollers, two rear rollers, on an eccentric shaft, and the hydraulic rear roller jack. The front roller axles are held in metal eccentric bushes in the carriage, so that the rollers can be adjusted in their bearings when necessary.

The rear rollers run on an eccentric shaft supported in bearings in each bracket. The shaft is fitted with a crank to which the ram of the hydraulic jack is attached.

The jack used is the rear roller jack, common to 35- and 38-ton, and some naval carriages. It is marked left hand.

NOTE.—Right hand are only used in right hand turret carriages.

The jack is attached to the left side of the carriage by a trunnion forming part of the reservoir. The trunnion is held in a metal-bushed bearing near the top of the carriage bracket, the ram being attached by a pin to the crank on the eccentric shaft. The spindle of the pump passes through the end of the trunnion, where the lever handle fits on it. The pump is double-acting, similar to that in the hydraulic lift, described already.

The release valve is internal, and is brought into action by pressing the handle to the rear beyond the ordinary stroke.

Care must be taken in raising the carriage on its rollers, not to carry the lever too far to the rear, or lowering will commence.

A pointer is attached to the end of the rear roller eccentric shaft, on the left side, to indicate the extreme limit to which the jack should be pumped up.

NOTE.—In some of the jacks first issued the release valve was external.

Clip Plates.

These prevent the carriage jumping when the gun is fired. One is fitted on each side to the front transom, and projecting under the top flange of the platform. Each clip is secured by four bolts, passing through it and the front transom. In the 6 feet recoil carriage, an additional bolt passes through the clip and the hydraulic buffer bracket.

It is necessary to see that these are attached before the gun is fired. They must be taken off before the carriage is dismounted.

PLATFORMS.

(*List of Changes*, §§ 3836, 4253.)

Plates X, XI, XII.

The various platforms are of wrought iron, with girder sides "fish bellied" in form. For 6 feet recoil the platforms are 15 feet 6 inches long, and for 7 feet recoil 16 feet 9 inches* long, with a slope in either case of 4° towards the front.

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* In platforms altered and lengthened 3 inches by the addition of malleable cast-iron brackets.

(*Platforms, Small-port—continued.*)

The terms 6 feet and 7 feet recoil are nominal only, and are used to designate the two descriptions of platform. The recoils are as shown in the following table:—

Nominal.	Buffer stops in contact but not compressed.	Protrusion beyond imaginary pivot of face of muzzle, front stops compressed 1½ inches.
6 feet recoil.	5·9	1–11·5
7 „ „	*7·0	

As the carriage in running up will compress the front buffers about 1·25 inches, the actual recoil of a carriage on a 6 feet platform should not exceed 5 feet 10¼ inches, when the rear stops will be touched, but not compressed; on a 7 feet platform, with lengthened sides, it should not exceed 7 feet 1¼ inches.

In both descriptions of platforms, the sides are connected by four transoms only, a front top plate and a rear bottom plate. Truck plates are fixed under the sides, to which the flanges for the trucks are bolted. The front truck-plate is bent downwards to clear the hydraulic buffers, and a semi-circular recess cut on the rear edge strengthened by angle-iron to clear the hydraulic lift on the carriage. In 6 feet recoil platforms the front truck plate is not extended to the front transom; in 7 feet recoil it is secured to the front transom, which is strengthened by a plate and packing-pieces, at the holes for the piston-rods of the hydraulic buffers. The rods pass through the second transom, and are secured by nuts at the front and rear of the front transom. Access to the inner nuts is obtained by openings in the truck plate.

In both descriptions of platforms a plate is secured to the front transom, and extends along the centre of the platform to the fourth transom to facilitate the removal of the hydraulic lift.

The parts of the platform are—

Two front trucks.
Two rear trucks.
Two hydraulic buffers (6 feet recoil platforms only).
Hand post and sighting steps.
Foot board.
Preventor bar.
Front buffer stop with four spindles.
Rear buffer stop.
Traversing gear.
Running-back gear.
Two snatch blocks.
Traversing pointer.

Trucks.

The front trucks, which have two flanges, are coned to the angle due to their diameter and distance from the pivot. The rear trucks, which have only one flange, are not coned. All the trucks are of steel bushed with metal, and are interchangeable with those of the 38-ton casemate. The truck axles are secured in position by a screwed nut and pin (formerly by a collar and pin).

Diameter of trucks over flanges for either 6 feet or 7 feet recoil .. .. .. { Front, 13 inches. Rear, 18 inches.

* In platforms altered and lengthened 3 inches by the addition of malleable cast-iron brackets.

(Platforms, Small-port—continued.)

Hydraulic Buffers (6 feet recoil only).

Two compression buffers on 6 feet recoil platforms are used to reduce the recoil. The cylinders, which are not connected by a pipe, are fixed at the rear of the platform near each girder side. The end of the piston rods are secured to brackets under the front of the carriage. When the carriage is run up, the pistons are drawn to the front ends of the cylinders, the oil passing behind them; on recoil the pistons are forced up the cylinders, the resistance to their passage checking the recoil. The oil passes from the rear to the front of the pistons through holes in them, the size of which is fixed by the estimated velocity of the recoil; the larger the charge the smaller the holes should be.

The following are the principal parts of each buffer:—

*A wrought-iron cylinder.
A wrought-iron front cap.
A wrought-iron rear cap.
A wrought-iron piston.
A wrought-iron piston rod with nuts.

The cylinder is 6 feet 6 inches long, about $\frac{3}{4}$ inch thick, and 7·56 inches internal diameter. The rear cap is screwed upon the rear end. The front cap is screwed upon the front end and is fitted with a packing gland for the cotton packing.

The filling hole is at the rear of the cylinder on the upper surface, and is tightly closed by an iron screw plug with leather washer. The draw-off cock is on the outside of the platform, and connected by a copper pipe to the front of the buffer.

The piston is 7·54 inches in diameter, and has four holes ·65 inch diameter. The piston is screwed on the piston rod and secured by a set screw. The rod is 3·5 inches diameter, and is fitted at the front with two nuts, one for each side of the buffer bracket when it is secured to the carriage.

Traversing and Running-back Gear.

The traversing and running-back gear is worked by the same horizontal shaft under the platform, which is set in motion by two winch handles, working within the length of the platform. This shaft has two pinions riding loosely upon it, a bevel pinion for the traversing gear, and a spur pinion for the running-back gear. By means of a double clutch, either pinion is made to revolve with the shaft. For traversing, the bevel pinion is connected by a longitudinal shaft, having at the front a metal pinion which gears into a cast-iron rack let into the floor of the work. For running back, the spur pinion gears into a spur wheel on a cross shaft. This shaft has two sprocket wheels with teeth that fit into endless chains, one at each side of the platform. The chains, to which the carriage can be attached when necessary, at the front pass over plain wheels in adjusting forks; the latter are held in brackets secured under the front truck plates of the platform.

For adjusting the forks and tightening the chains, a special spanner is supplied. "Spanner, socket, tightening chain, with tommy," and a "turnscrew connecting chain," is used for uniting the chains.

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* Steel in future manufacture.

(*Platforms, Small-port—continued.*)

Clutch.

The double clutch consists of a series of discs or plates on the shaft, alternately of steel and gun-metal. The former are circular in shape and revolve with the shaft loosely inside recesses in the pinions; the latter are octagonal, or some similar form, so as to fit the recesses in the pinions but ride loosely on the shaft.

By means of the clutch lever the plates on either pinion are forced together and motion given to the pinion required.

The clutch lever pivoted at the centre is moved by means of a hand wheel on the left side of the platform, through a screw shaft with a nut in the forked end of the front of the lever.

The clutches are similar for both kinds of platforms, varying chiefly in the diameter and number of plates.

6 feet recoil, Mark II, § 4026.
6 feet recoil, Mark III, } § 4112.
7 feet recoil, Mark I, }

Indicator.

On the screw shaft, behind the hand wheel, is an indicator. This consists of a disc with a spiral groove on its face, in which travels a pointer sliding in a bracket on the side of the platform. The bracket is marked with the letters R. O. T., respectively for "running back," "out of gear," and "traversing." In small-port platforms when the hand wheel is turned to the right (or towards the rear of the platform), the spiral groove in the disc, as it revolves with the hand wheel, raises the pointer towards the position marked T, which shows that the gear is in readiness for traversing.

Hand Post and Sighting Steps.

Vide Casemate and Dwarf Mountings, p. 15.

Preventor Bar.

The front and rear of the bar is secured by a pin with split key to brackets respectively on the front and rear truck plates. A tripper is attached to the right girder on the outside, to bring the gear into action automatically (*see* "Preventor Gear on Carriage").

Front Buffer Stop.

This is to prevent any injury to the carriage or platform in running up. It consists of a block of wood fixed to the second transom at the front of the platform, and four buffer spindles, each with seven india-rubber rings and six parting plates. Each spindle is secured by a split key at the front.

Rear Buffer Stop.

A rear buffer stop is fixed on the front of the rear transom in such a position as to prevent any injury to the hydraulic buffers or pistons on recoil. It consists in either case of five indiarubber pads, four

parting plates, and for 6 feet recoil platforms a block of wood strengthened by an iron band, secured to the rear transom by three bolts with nuts. For 7 feet recoil lengthened, the wood is replaced by an iron block, and two malleable iron blocks are added to prevent injury by pistons at extreme recoil.

Snatch Blocks.

One is fixed on each side of the platform near the front, to lead the fall of the loading tackle in the direction required. It is attached by means of a shackle joint, with nut and pin, to a bracket secured to the outer flange of the girder.

Grease Box.

A "box, tin, grease, half round," 3 lbs., is attached by a leather strap, on the left side near the front of the platform, to contain grease for lubricating projectiles.

Racers

Are of steel; the front racer is bevelled at the upper surface to suit the trucks. In section, solid without flanges, they are tapered towards the top so as to allow the trucks to revolve freely without grinding.

The radii of the racers are as follows:—

		Front.	Rear.
Pivot A	6 feet recoil.. ..	10·2	20·2
	7 „ „	10·2	21·2

Stops.

The stops are of wrought iron, and are fixed in the masonry at the side of the racer, projecting $1\frac{1}{8}$ inch above the sinking for the flange of the truck, or $\frac{3}{8}$ inch below the top of the racer.

Traversing Pointer

Is of wrought iron, attached beneath the platform, on the right side, and points to a graduated metal arc in the floor of the work.

Traversing Arc.

The arc is of metal, and graduated to degrees and quarters; radius to centre of arc (6 and 7 feet recoil) 19 feet 4·25 inches.

Special Tools and Appliances.

These are as follows:—

1. Bar, lifting, hydraulic lift, R.M.L. 12·5-inch, small-port, Mark I.
2. Bracket, lifting hydraulic lift, R.M.L. 12·5-inch, small-port, Mark I.
3. Pipe, filling, hydraulic lift, R.M.L. 12·5-inch, small-port, Mark I.
4. Pipe, filling, hydraulic buffer, R.M.L. 12·5-inch, small-port, Mark I. (Not required for 6 feet recoil.)

(*Platforms, Small-port—continued.*)

5. Spanner, cistern cover and run-off plug, hydraulic lift.
6. Spanner, pump cap, hydraulic lift.
7. Spanner, release valve, filling plug and pump plunger, hydraulic lift.
8. Spanner, suction valve, hydraulic lift.
9. Tommy, large, hydraulic lift.
10. Tommy, small, hydraulic lift.
11. Wrench, spindle, gland, hydraulic lift.
12. Wrench, removing ram leather, hydraulic lift.

} R.M.L. 12·5-inch small-port, Mark I.

13. Measure, hydraulic buffer, draw-off, R.M.L. 12·5-inch 38-ton, small-port, naval 12·0-inch 35-ton turret, and 11-inch, 25 tons. (Not required for 6 feet recoil.)

In addition, for the hydraulic buffers, are required—

Spanner, hydraulic buffer, No. 2, for glands of 7 feet recoil buffers.
Spanner, hydraulic buffer, No. 5, for glands of 6 feet recoil buffers.
Spanner, hydraulic buffer, No. 6, for plug and cock of both 7 feet and 6 feet recoil.
Pan, drip, hydraulic buffer, No. 1, for glands of 6 feet recoil.
Pan, drip, hydraulic buffer, No. 2, for draw-off cocks of 6 feet recoil.

No drip pans are used with 7 feet recoil carriages.

INSTRUCTIONS FOR CARE AND PRESERVATION OF CARRIAGES AND PLATFORMS.

Casemate and Dwarf Carriages and Platforms.

1. The carriage must never be fired from until it is seen that the buffer piston-rod is attached to the platform; that the hydraulic buffer is filled with the proper quantity of oil; that the clip plates are on and secured; that the preventor gear lever is lowered to relax the grip on the bar; and that the nipping lever of the running-back gear is well pressed down and caught by its pawl, to ensure the sprocket plates being free of the chains. Before the carriage is dismounted from the platform, the piston-rod must be disconnected and pressed home, the clips removed, and the running-back chains detached.

Hydraulic Buffer.

2. The buffer will be invariably kept on the carriage, filled with the proper quantity of oil; and when not required for immediate use, the piston-rod will be disconnected from the platform and pressed home, after replacing the nuts, into the cylinder.

To fill the buffer.—Run the carriage up to the front stops, with the piston-rod secured to the front of the platform; take out the screw plug on the top of the buffer at the rear, and rest the gallon measure in the hole, turn off the cock, and fill the measure *full*; then turn the cock and allow the oil to flow into the cylinder, repeat the operation until the buffer is full, then draw off one quart. Replace the plug, screwing it home.

(Instructions for care and preservation—continued.)

The working quantity of oil used should not exceed .. .. { 6 feet recoil—10 gallons. 7 „ „ 11¼ „

Oil is withdrawn by means of the front screw valve, air being let into the cylinder at the same time, by the removal of the rear plug.

A "Spanner, hydraulic buffer, No. 2," is issued for loosening or tightening the packing gland of the buffer, and a "Spanner, hydraulic buffer, No. 6," for removing the rear plug, and for opening or closing the draw-off valve in the front buffer cap. A "Spanner, McMahon," is used for screwing and unscrewing the bolts and screws.

To connect the buffer piston-rod to the platform.—Move the carriage to the rear, if not already in that position, sufficiently to enable a man to get at the rear of the piston-rod, remove the connecting nut from it, and draw it forward until its end projects through the hole in the transom of the platform, taking care not to injure the thread; screw on the connecting nut, and secure it from turning by driving in the tapered steel pin; the inside nut should be adjusted so as to allow of a free vertical movement of the rod. Before connecting to the platform, the rod should be pushed in and out, to see that it works freely and that the packing gland is not too tight.

N.B.—In all operations, such as connecting and disconnecting the piston-rod of a buffer, care should be taken that the carriage is securely scotched up on the platform, to prevent its running up suddenly. Under no circumstances should the carriage be run up by placing it on its rear rollers, unless the piston-rod is secured to the platform.

If the buffer leaks at the gland, and the leakage cannot be stopped by tightening the latter, the packing must be renewed. Materials for packing are detailed in the following table:—

		First supply for each buffer.	Annual supply for five buffers.
For tension buffers	Lead .. red, dry .. .. ozs.	4	8
	Lead .. white, ground in oil „	4	8
	Leathers cap	1	5
	Leathers piston rod	1	5
	Oil, linseed, boiled .. .. pints	⅛	¼
	Rope, cotton, white .. .. ozs.	4½	9
	Tallow.. .. .. .. „	1½	3

If the cap has at any time to be removed, in replacing it, red or white lead should be used to make a close joint. In removing the piston, it is better to take the buffer off the carriage and remove the front cap, first taking out the set screw.

During practice the surface of the platform upon which the carriage slides, will occasionally be rubbed with cotton-waste, or a cloth slightly oiled to prevent seizure between the carriage and platform, and to secure uniformity in the action of the buffer.

Rear Roller Jack.

A moderate pressure must be constantly maintained on the leather packings of the hydraulic jacks, to preserve them in good condition and prevent leakage. With this object the carriage must be run back until it is in contact with the rear stops, and secured in that position

by suitable skidding† placed between the front of the platform and the front transom of the carriage. The jack must then be pumped up sufficiently to throw the carriage on its rollers, and pumped up from time to time to keep the carriage in that position.

Spare jacks in store must be pumped up in the "Frame, store, hydraulic jack" (§ 4774, List of Changes), to keep the requisite pressure on the leathers, special blocks being supplied for use with this nature of jack. The jacks must be lashed to the "frame" to prevent them falling, in the event of the pressure going off (*vide* Plate XIV).

**To fill the jack.*—Remove the cover by taking out the four screws, and fill the jack with the authorised fluid. The mixture must be filtered into the jack through the "Filter, tin, jack, lifting" (§ 3794, List of Changes).

*The authorised fluid to be used with the jacks, consists of the following mixture, viz.:—

Methylated Spirits	7 gallons.
Water, distilled	3¼ ,,
Oil, mineral	¼ ,,
Carbonate of Soda	250 grains.

*The jack must be cleaned out every three months, and the mixture passed through the filter when returning it to the reservoir.

*Capacity of the jack—4 quarts.

*Should the rear roller jack not act, it should be rapidly worked, at the same time tapping the outside of the cistern with a piece of wood, to dislodge any dirt that may have got into the pumps. If this has no effect, it should be removed, and replaced by one from store. The jack out of order should be cleaned out as directed above; if it still remains out of order, it must be carefully taken to pieces, examined, and adjusted by a competent person.

*If the jack should break down in *action*, the gun in cases of emergency can be run up by using the nipping and running-back gear, the indicator being adjusted for running back, and the winch-handles worked in the reverse direction.

*Care should be taken not to pump the rear-roller jack too high, thereby jamming the eccentric shaft. About three-quarters of an inch should be sufficient as a general rule, which height is that for which the pointer should be arranged.

*Where preventor gear is not fitted, in running up, care should be taken to lower the jack as soon as the carriage starts, to prevent the carriage running against the front stops with violence.

Preventor Gear.

*Should it be found that the gun is running up too quickly, the preventor gear must be set up by hand by raising the lever on the outside of the right bracket. If this gear is in proper adjustment, the carriage should be brought to rest as it comes in contact with the front buffer stops. Should the gear require adjusting, remove the retaining nut and pin and change the position of the lever on the screw as required; the higher the number on the shaft to which the arrow on the lever points the greater the compression. The nut and pin must be replaced before testing the resistance.

† 5′ 8″ × 6″ × 4″ for 6 ft. recoil mountings, 6′ 8″ × 6″ × 4″ for 7 ft. recoil.

(Instructions for care and preservation—continued.)

*In general, the proper amount of check will be obtained if, with the full force of one man on the lever, its tripping end can be raised to about one inch below the top of the tripper.

*NOTE.—Immediately the carriage is run up, the grip on the bar must be relaxed by lowering the lever, to prevent the movement of the carriage being retarded while running back, or during recoil.

Elevating Gear.

5. Should the position of the clamp handle elevating gear be found inconvenient when the arc is clamped, it can be adjusted by removing the split key and handle, placing the latter in a new position, on the hexagon of the screw, and replacing the key. No oil or grease should be allowed on the friction pieces of the clamp.

Running-back Gear.

*Should the running-back chains not be in a position suitable for the engagement of the sprocket plates in the nipping gear, move the chains slowly by the winch handles, at the same time pressing the nipping lever on the carriage steadily up, until the teeth catch in the chains.

*The clutch should, after each movement, be disengaged by turning the hand wheel until the indicator is at "O" in the centre. The letters T. and R. merely indicate the direction in which to turn the hand wheel. The amount of turning should be only such as will set the clutch and prevent any slip. After the clutch is engaged and movement commences, it may be eased off to lessen the end thrust. Care should be taken that no oil or grease is upon the plates of the disc-clutch, and that if at any time they are removed, when replacing them that they are free from dirt and rust. The clutch-lever has a band with trunnion, which is provided with a lubricating hole. Oil should be supplied to this.

NOTE.—On no account must this gear be used as a "brake" in running up, as such use will cause serious damage to the gear, and render it unserviceable.

*TO PUT ON THE RUNNING-BACK CHAINS.—These can be put on more easily before the gun is mounted. Slacken the nuts of the tightening fork, using the special spanner for this purpose; attach a 2-inch rope to one end of the chain and haul it under the platform from rear to front, pass the end of the rope up and over the wheel in the fork, through the nipping gear bracket, under the carriage, and haul the chain through to rear of carriage; the other end of the chain is then passed over the sprocket wheel of the platform. Detach the rope from end of chain and fasten it to the third link from the opposite or rear end, passing it through the third link from front end, and over the rear of the platform. Turn the winch handles, taking up the slack of the rope, till the ends of the chain are brought together. Insert the pin and screw up with the "Thumbscrew, connecting chain, 35- and 38-ton." Then tighten the nuts on the forks.

*In detaching the chains the ends should be brought together by a rope in a similar manner, after loosening the fork, so as to take the strain off the screw pin while being taken out.

**Front rollers.*—The carriage rollers should revolve freely by hand upon their axles, and only take a bearing on the platform when the

(*Instructions for care and preservation—continued.*)

eccentric is thrown into gear. This should be done by pumping the rear roller jack until the carriage at the rear rollers is raised ¾ inch. In this position there should be a clear space between the surfaces of the carriage and platform sufficient to see light. Should this not be the case, the front roller bearings will require adjustment.

Front buffers.—The faces of the buffer blocks upon the carriage and platform should be parallel one to the other, or else the spindles of the buffers are liable to be bent. (Casemate and dwarf only.)

Lubrication.

*Too much care cannot be exercised in keeping axles, spindles, pinions, and their bearings clean from clotted oil, grease, and rust, and properly lubricated; also that when oil is poured into the lubricating holes, it reaches and lubricates the bearings. This can be seen by observing that the oil shows on the shaft at each end of the bearing.

*Should a lubricating hole be stopped up, it must be carefully cleaned out with a piece of pointed wire, until it is found that the oil reaches and fully lubricates the bearings.

The top of the platform must be rubbed with an oily rag to keep it from rusting and to keep the under surface of the carriage in good condition, the carriage must be raised on its rollers, and oil poured under it as far as possible, then lowered and worked a little backwards, and forwards by means of the chain gear sufficiently to oil the whole surface.

NOTE.—All superfluous traces of oil must be removed before firing, but a slight film should be renewed during practice as directed in a previous paragraph (p. 29).

*Traversing gear should be worked once a week to test its condition, and also that the position of the platform on the racers may be changed. The toothed gearing and pinion working in the rack should be kept thoroughly clean, the teeth slightly greased. The discs of the clutch should not be oiled, but the clutch lever band should be. (*See* "Running-back Gear.")

*All nuts must be kept tightened up, and care must be taken that none of the loose parts become indented by being thrown down or by striking one against another, or with a hammer; no hammer should be used where it can be avoided, but they should be tapped home with a piece of wood.

* Should a screw go very tight it must be withdrawn and examined, and if it is found that the bearing or screw has been indented the burr must be carefully removed with a file. A screw should have a drop of oil placed on it before insertion. (For casemate and dwarf mountings only.)

Before the platform and carriage are used all the lubricating screws should be taken out, and oil poured into the holes and the screws replaced. Some of the screws are under the foot boards inside the rear of the platform. By taking out the key of the left buffer spindle, removing the spindle and indiarubber ring, the boards can be lifted out and the lubricating screws taken out for oiling. They must then be replaced, as well as the boards and buffer spindle.

(Instructions for care and preservation—continued.)

Rollers and Trucks.

*The rollers and trucks should be removed from the carriage and platform periodically (at least once a month), the axles cleaned of clotted grease and grit, coated with fresh grease, and replaced.

**To remove the front trucks.*—Run the gun back as far as possible, lift the front of the platform about half an inch, using one hydraulic jack, placed under each side of the front transom; block the platform up securely, and remove the axles, the trucks can then be removed and cleaned.

**To remove rear trucks.*—Run the gun up as far as possible, and proceed as for the front trucks, but taking the lift with the hydraulic jacks under the rear truck plate.

**Racers, racks, soles of trucks*, and pivots will not be painted, but rubbed occasionally with an oiled wiper to prevent rust. The pivot plug should be moved and cleaned in a similar manner to prevent rust.

**Parts that may be removed.*—In an exposed situation or near the sea, when not required for immediate use, the front rollers with their axles, the movable parts of the elevating gear, the rear roller jack, and those portions of the gear which can be readily replaced, may be placed in store, the securing screws being left in the holes. The articles removed must be kept perfectly clean and in good condition, and will be fitted into their places and worked at least once a month. It is unnecessary either to paint the metal work or to keep it bright.

The bright parts of the gear which are left on will be coated with Field's grease No. 3. When likely to be required for immediate use the whole of the gear must be left on, and a coating of the grease before mentioned applied to the bright parts. The grease can be easily removed when necessary and the parts recoated.

To lift the gun at the muzzle when mounted.—Run the carriage back over the rear compressor, fill in the space between the under side of the carriage and the compressor plates, place skidding inside the carriage, on the bottom plate, for the breech of the gun to rest upon; then the weight of the breech can safely be allowed to rest on the bottom of the carriage. The elevating arc should be removed before lifting the gun.

**To remove clutch shaft.*—Take out the pin in collar of indicator screw and run the screw out of the nut; remove the bracket carrying the clutch lever, take off the caps of the bearings of the cross shaft and of the traversing shaft, and in casemate platforms, loosen the bolts in the front bracket of the traversing shaft.

*Loosen the bolts of the thrust brackets; lower the cross shaft and remove it, first blocking up the shaft to prevent its falling. When out, remove the clutch lever by taking out the screws.

*Any difficulty in moving the mountings, or extra exertion required to work the gears is due either to deficient lubrication or to the connection of some of the gears which are not then in use. In either case the officer commanding should at once halt the detachment, and ascertain the cause, as to continue working under the circumstances may be the means of putting the gun out of "action."

*N.B.—In all letters or reports with reference to gear on carriages and platforms, their registered number should be quoted.

These paragraphs marked *, for care and preservation of carriages and platforms, apply not only in the case of casemate and dwarf but also in that of the small-port mountings.

(*Instructions for care and preservation—continued.*)

Special for Small-port Carriages and Platforms only.

1. The carriage must never be fired from, until it is seen that the buffer piston-rods are attached to the carriage, in the case of the 6 feet recoil, or to the platform, in the case of the 7 feet recoil; that the hydraulic buffers are filled with the proper quantity of oil; that the clip plates are on and secured; and that the trunnion blocks rest on the following-up screws, so that no weight rests upon the hydraulic lift. Before the carriage is dismounted from the platform, the piston-rod must be disconnected and pressed home, the clips removed, and the running-back chains detached.

Hydraulic Buffers.

The buffers will be invariably kept on the platform or carriage respectively, filled with the proper quantity of oil, and when not required for immediate use, the piston-rods will be disconnected and pressed home after replacing the nuts, into the cylinders.

To fill the buffers. 6 feet recoil.—Run the carriage up to the front stops, with the piston-rods secured to the buffer brackets, under the carriage; take out the screw plug on the top of the buffer near the rear, and rest the gallon measure in the hole; turn off the cock and fill the measure *full*; then turn the cock and allow the oil to flow into the cylinder, repeat the operation until the required quantity is run in. Repeat the same with the second buffer. The greatest quantity of oil in each buffer should not exceed 9 gallons, which with the carriage run up, will give $3\frac{1}{8}$ inches depth of oil at the filling hole. This depth may easily be tested by pressing a slip of wood to the bottom of the cylinder, withdrawing it and measuring the wetted portion. Replace the plug, which has a leather washer, screwing it home. Oil is withdrawn by means of the front valve, air being let into the cylinder at the same time by the removal of the rear plug. Each buffer must be filled separately, and great care should be exercised that each contains exactly the same quantity of oil, so that the pressure in each buffer may be the same during recoil.

To fill the buffers, 7 feet recoil.—Run the carriage not quite up to the front stops, so that the piston may clear the filling hole, with the piston-rods secured to the front of the platform; take out both screw plugs in the top of the buffers, insert the "Pipe, copper, filling, hydraulic buffer," in the filling hole, and resting the gallon measure in the pipe, fill the buffers as full as possible, then run the carriage gently up and finish filling; run the carriage back until the draw-off valve is clear of the front truck plate, and using the special draw-off measure take out one quart for each buffer. As the buffers are connected by a copper pipe, the quantity of oil required for both buffers can be run in through one filling hole and the necessary quantity can be drawn from either draw-off valve. Replace the plugs, taking special care to screw them home. The working quantity of oil used in each buffer should not exceed $7\frac{1}{2}$ gallons.

A "Spanner, hydraulic buffer, No. 2," is issued for loosening or tightening the packing gland of the buffers of the 6 feet recoil platforms, and a "Spanner, hydraulic buffer, No. 5," for the same purpose for the 7 feet recoil. A "Spanner, hydraulic buffer, No. 6," for re-

(Instructions for care and preservation—continued.)

moving the screw plug, and the draw-off cock in the 6 feet buffers, and the screw valve in the 7 feet buffers. A "Spanner, McMahon," is used for screwing and unscrewing the bolts and screws.

To connect the buffer piston-rods.—Move the carriage to the rear, if not already in that position, sufficiently to enable a man to get at the brackets under the carriage in the case of 6 feet recoil, and on front of the platform in the case of 7 feet recoil; remove the connecting nut from each piston-rod, and draw the latter forward until its end projects through the hole in the bracket or front of the platform; keeping the piston-rods central in the hole, and taking care not to injure the thread; screw on the connecting nut. In the 6 feet recoil, when quite tight take half a turn back to allow a slight play. In the 7 feet recoil secure the nut by the taper steel pin; the inside nut in the latter case being adjusted so as to allow of a free vertical movement of the rod.

Before connecting the piston-rod to either carriage or platform, it should be pushed in and out to see that it works freely, and that the packing gland is not too tight. In all operations, such as connecting or disconnecting the piston-rod of a hydraulic buffer, care should be taken that the carriage is secured on the platform by scotches, to prevent it running up suddenly.

In the 7 feet recoil, having tension buffers, the carriage must under no circumstances be run up by placing it on its rollers, unless the piston-rods are secured to the platform.

If the buffer leaks at the gland, and the leakage cannot be stopped by tightening the latter, the packing must be renewed. Materials for packing are detailed in the following table:—

			First supply for each buffer.	Annual supply for five buffers.
For compression buffers.	Cement, Scott's	lbs.	¼	½
	Tallow	oz.	1½	3
	Oil, linseed, boiled	pts.	⅛	¼
	Yarn, spun	oz.	2	4
	Flax	small ball*	1	2
For tension buffers.	Lead — Red, dry ..	oz.	4	8
	Lead — White, ground in oil	oz.	4	8
	Leathers — Cap	No.	1	5
	Leathers — Piston rod ..	No.	1	5
	Oil, linseed, boiled	pts.	⅛	¼
	Rope, cotton, white.. ..	oz.	4½	9
	Tallow	oz.	1½	3

* Rope, cotton, white, as per tension buffers, can be used instead of the flax and yarn.

If it is necessary at any time to remove the piston from a tension buffer the buffer must be removed from the carriage and the rear cap, if possible, taken off; should this not be practicable, the front cap may be removed, first taking out the set screw in the bracket.

When replacing the front cap, red or white lead must be used to form a joint; also care must be taken to see that the leather packing ring in the cap is in good condition; and that the cylinder is screwed

hard home upon the leather packing, and that the hole for the equalising pipe is in its proper position, thicker or thinner packing rings being used to secure this object.

This operation should only be attempted with skilled labour, such as ordnance artificers.

If the rear cap of a compression buffer has at any time to be removed, in replacing it red or white lead should be used to make a close joint. In taking such a buffer to pieces the front cap is never removed, nor the draw-off valve.

During practice the surface of the platform, upon which the carriage slides, will occasionally be rubbed with cotton waste or a cloth slightly oiled, to ensure uniformity in the action of the buffers.

Hydraulic Lift.

The hydraulic lift should be worked daily, to ensure that the leathers on bottom of ram are kept in working order. The plate on top of ram, should work freely, so as to enable it to get the proper grip of the gun. It should be removed, when necessary, by the screw underneath being taken out, cleaned, slightly oiled, and replaced; great care being taken that no oil gets on the ram, which should be kept clean by wiping with clean oakum or waste.

To fill the lift.—Remove the screw plug in the cover of the cistern, using the "Spanner, release valve, filling plug," &c., insert the "pipe, filing hydraulic lift," and using the "Filter, tin, jack lifting" (§ 3794) in the pipe, fill the cistern with the authorised fluid,* replace the screw plug. Capacity of the cistern, two gallons.

The cistern is emptied, by withdrawing the run-off plug under the cistern, using the "Spanner, cistern, cover, and run-off plug."

The lift must be cleaned out every three months, and the fluid passed through the filter, when returning it to the cistern.

To remove the lift from the carriage.—Remove the six keys and the plate from the front transom; remove the bearings of the shafts connecting the pump spindles with the levers outside of the carriage, also the shafts. Draw the lift forward, clear of the carriage, until it rests on the plate along the centre of the platform, then by means of the "bracket, iron, lifting," and the "bar, wood, lifting," remove the lift from the platform.

Parts liable to get out of order.—The parts of the lift most liable to get out of order are the leather packings; those round the crank spindle, and the draw-off and filling plugs, would cause the lift to leak externally, and any disorder in them can easily be detected and replaced with new; while those in the ram and pump would injure the lifting power, and would necessitate the removal of the lift from the carriage, its being taken to pieces, and carefully examined.

For any examination of the working parts, the lift must be removed from the carriage (see instructions for that purpose).

To get at the inlet valve.—Remove the run-off plug; remove the suction pipe of the inlet valve, through the hole for the run-off plug,

* The fluid is the same as that described for hydraulic jacks, page 30.

(Instructions for care and preservation—continued.)

using the "spanner, suction valve," when the valve will come away with the suction pipe, and the valve and its seating can be examined.

To get at the outlet valve.—Remove the cover of the reservoir, by taking out the bolts with the small end of the "spanner, cistern cover, and run-off plug," remove the cover of the outlet valve, using the "spanner, pump, cap," when the valve can be removed and examined.

To get to the plunger.—Proceed as "to get at the outlet valve," in removing the cover, when the plunger can be withdrawn, and the leather packing examined. In some plungers the packing consists of a leather collar; should this need renewal, remove the screw collar on the end of the plunger, using studs in the "spanner, release valve," &c., when the leather collar can be removed and replaced with a new one. In some plungers, the packing consists of a long strip of leather; should this need renewal, the old strip must be carefully removed, and replaced with a new one, winding it round until the recess is quite full, and then carefully forcing the end into the recess.

To get to the leather packing in the cap of the pump.—Having removed the cover of the reservoir, remove the cap of the pump, using the "spanner, pump, cap."

To get to the release valve.—Remove the small covering screw in the upper part of the plunger, using the "spanner, release valve," when the valve can be removed and examined.

To get to the packing leather on the end of the ram.—Remove the ram from the cylinder, and use the "wrench, steel, removing ram leather," to remove the metal disc securing it in position.

To get to the leather packing rings round the pump spindle.—Remove the gland at each end, using the "wrench, spindle gland."

NOTE.—The covers of inlet, outlet, and release valves have leather seatings; these must be attended to when the pump is taken to pieces.

Following-up Gear.

The position of the following-up screws should always correspond with the height of the gun, as shown by the indices at the trunnions; this can readily be seen by the index plate and pointer on the left bracket of the carriage.

Great care must be taken before firing to ascertain that the weight of the gun rests on the following-up screws, and not on the hydraulic lift.

Elevating Gear.

Should the position of the clamping handle be inconvenient when set up, it can be adjusted by means of the screw on the end of the elevating spindle.

Should any play (or back lash) occur in the teeth of the pinions moving the screw of the elevating scale, the friction cone in the pinion must be loosened, the lower pinion pressing against the driving side of the teeth on the wheel into which it is geared, while the upper is pressed against the opposite side of the teeth, in this position the pinion is again secured by setting up the friction cone.

Should the elevating scale not register the slightest movement of the screw to which it is attached, the nut at the back of the scale must

(*Instructions for care and preservation—continued.*)

be adjusted to press against the opposite sides of the threads of the screw, by means of the two adjusting screws.

The elevating gear should always be moved in strict accordance with the instructions given on the plate fixed on the carriage (otherwise in lowering, the gear may be strained), which are as follows:—

Elevating or Depressing.—Work the bottom hand wheel until the left hand arrow points to the nearest degree and tens of minutes, continue in the same direction until the vernier gives the remaining minutes.

Raising the gun.—While raising the gun, work the top hand wheel until the arrow on the right points to the required station.

Lowering the gun.—For any station between 14 and 7 set the gun to "point blank." While the gun is being lowered, let the breech descend at the same speed as the trunnion, by turning the bottom hand wheel. Work the top hand wheel until the right hand arrow points to the required station. For any station between 7 and 3, set the gun to 3 degrees elevation, and proceed as described above.

For any station between 3 and 0, set the gun to 3 degrees elevation and proceed as above.

Preventor Gear.

(*See Instructions marked * for Casemate and Dwarf mountings.*)

Rear Roller Jack.

(*See Instructions marked * for Casemate and Dwarf mountings.*)

Running-back Gear.

(*See Instructions marked * for Casemate and Dwarf mountings.*)

Lubrication.

(*See Instructions marked * for Casemate and Dwarf mountings.*)

The gun should be elevated and depressed frequently, to prevent the trunnions sticking in the blocks, the loops on top of the block being removed when necessary, a few drops of oil poured in, and the loops replaced.

The gun should be run up and back, raised and lowered at least once a week, all lubricating screws removed, the holes cleaned and oiled, and the screws replaced. Dust should not be allowed to accumulate in the casemates or passage, as it blows into the fittings, gear, &c., and in time puts them out of order. Particular care should be taken to prevent dust or bath brick getting on the screws of the elevating gear, which, after cleaning, should be left slightly oiled. It is unnecessary to keep metal work bright; careful cleaning and lubrication only are required.

Rollers and Trucks.

(*See Instructions marked * for Casemate and Dwarf mountings.*)

Turntables.

In certain positions where it has been found necessary to give to heavy guns, protected by armour, an extended range of lateral fire, a special type of casemate has been provided.

These casemates have curved armoured fronts, with two gun ports in each, and the gun is mounted on the service carriage and platform, on a large turntable, which is so constructed as to admit of the gun being trained through an arc of 60° at one port, and of being transferred to the other port, at which also it can be trained through a similar arc.

Cases of this kind occur at the following places, viz.:—

Spithead Defences	St. Helen's Fort,	2	casemates for	18-ton guns.
Gibraltar ..	Prince Albert's Bastion	1	„	38-ton „
	King's Bastion,	1	„	„ „
	Wellington Front,	1	„	„ „
	Alexandra Battery,	1	„	„ „
Malta	Sliema Battery,	2	„	„ „

Each turntable consists of the following parts, viz.:—

A strong circular platform of girder work, varying from 20 feet to 23 feet in diameter, covered with a removable boarded floor, and carrying on its beams the gun racers.

Under the centre of the turntable is a massive casting, firmly secured to the masonry of the fort, and into this a strong central spindle passes through the platform.

The under surface of the platform rests, at its outer rim, on a set of conical rollers of steel (hard cast-iron at St. Helen's Fort) running in a live ring. The rollers travel on circular paths made of steel, except at St. Helen's Fort, where they are made of wrought-iron.

The circular path is held to the central casting already mentioned, by radial bars, and the live ring is confined to its proper circular movement by radial bars attached to a ring set on the central casting.

The turning of the table is effected by means of simple hand gear, working into cogs set on the outer edge of the turntable platform, a little below the level of the floor.

The whole of the turntable and the turning gear are contained in iron casings.

Tumbler stops, set in the floor, and worked by hand, engage with corresponding notches in the table when it is in the proper position to allow the guns to be worked.

One of these stops, also, when put in action, throws out the turning gear, and thus prevents any shock from firing being transmitted to the men at the handles.

A leather flap, attached to the outer edge of the turntable, and protected by steel strips, travels with it round the floor, and is intended to prevent any dirt from reaching the roller path.

The bushes of the central spindle can be lubricated by oil holes in the floor, and those of the rollers by oil holes in the inner faces of the latter.

All the bearings of the turning gear can be got at by removing the cover of the cast-iron casing in which it lies.

The principal points to be attended to in working are—

To keep the bearings of the machinery and the bushes of the turntable greased with lubricating oil, and the teeth of the wheels with Field's grease.

To keep all moving parts free from dirt and grit, and especially to

(Turntables for heavy guns—continued.)

keep dirt from falling down between the fixed and moving parts, and lodging on the rollers or roller path.

Never to fire the gun unless the turntable is locked by the stops. Neglect of this precaution would cause serious injury to the men at the turning handles.

For ordinary examination, the tables should be revolved one-quarter turn every alternate day, or three times a week; lifting the floor, and lubricating the bearings as required.

Should it appear that more than usual force (three men at St. Helen's, and four men at Malta and Gibraltar) is required to move them, the table should be raised by means of the lifting gear supplied to each station, and the parts cleaned and lubricated as laid down for periodical examination.

Periodical examinations for purposes of extra cleaning, and of repair, when necessary, should be made every six months.

The turntable should be raised by the lifting gear to a sufficient height from the live ring (without dismounting the gun) to admit of the bushes of the central spindle being thoroughly examined and cleaned, and of the spindles of the rollers of the live ring being taken out and cleaned and adjusted, and of all rust or dirt being removed from the upper and lower roller paths and live ring.

The lifting gear consists of four long vertical screw bolts, supported at the upper ends by nuts resting on washer plates on the roof of the casemate, through which they pass, whilst their lower ends are secured to wrought-iron cross-bars, inserted under the girders of the platform at Gibraltar and St. Helen's, and to washer plates attached by short bolts and other washer plates to the girders of the turntable at Sliema Battery.

The nuts on the roof are provided with large spanners. Those at Gibraltar and Malta have four arms each, and those at St. Helen's two arms each, and each arm is capable of taking two men.

By working these nuts round the bolts, the table can be raised, but hydraulic jacks standing on the floor under the table, and bearing against the cross bars or washer plates, should be employed to assist the screws in lifting.

The lowering should be done by the screws alone.

Care must be taken that all the lifting bolts are equally tight to commence with, and that the nuts are turned simultaneously, and through precisely the same number of revolutions, both in lifting and lowering, and that they are not lifted from their seats by too quick a motion of the hydraulic jacks.

It will be found to be a safe and convenient plan to order a given number of turns of the roof spanners, say six for a spell, all the four parties turning being halted at the end of each spell, and waiting for a fresh order.

The pinion of the turning machinery, which works into the cogs on the edge of the turntable, must be disconnected, and everything kept quite clear before commencing to lift. Care must be taken that the threads of the main screw bolts do not bear against the washers or sides of the holes through which the bolts pass.

The gun should be run back 4 feet at St. Helen's, 4 feet 6 inches at Gibraltar, and 2 feet 3 inches at Malta, so that the load may be divided uniformly among the bolts.

The screw threads should be liberally supplied with lard oil, and, when not in use, the gear should be kept under cover and clean.

(Turntables for heavy guns—continued.)

Custody.

The turntables will remain in charge of the Officer Commanding Royal Artillery, who will undertake the moving of the turntable, and such lubrication as can be done by merely lifting the floor. The lubricator and cleaning of the turntable, its live ring and turning gear, which requires the turntable to be lifted, will be done by the Royal Engineer Department on requisition, the lubricating, &c., being supplied by the Officer Commanding Royal Artillery, who will be responsible that the requisitions are made in proper time, the Commanding Royal Engineer being responsible that the cleaning and lubrication are duly and most carefully carried out.

Repairs will be executed in the usual way, on requisition, by the Royal Engineer Department.

Detailed drawings are in the possession of the Commanding Royal Engineer at each station, who will place them at the disposal of the Officer Commanding Royal Artillery when required.

Until further experience has been gained, the following quantities of oil, &c., for lubrication, will be allowed for each turntable:—

Lard oil, for bearings	20 gallons.
Field's grease, for teeth of gear	2 cwt.
Hemp	28 lbs.
Turps, for cleaning off oil when set	2 gallons.
Oil feeder	1.

AMMUNITION.

PROJECTILES.

(List of Changes, §§ 3375, 3376, 3377, 3635, 3899, 4049, 4116, 4266.)

Plates XV, XVI, XVII, XVIII.

Nature.			Mark.	Weight. Empty. ± 1·5 p. c.		Charge.		Gas-check.		Total. ± 1·5 p. c.
				lb.	oz.	lb.	oz.	lb.	oz.	lb.
Shell	Common	Studded	I	780	8	29	4	17	3½	827
		Studless	I	769	5½	33	0	15	10½	818
	Shrapnel	Studded	I	803	6	2	7	17	3½	823
		Studless	I	799	14½	2	7	15	10½	818
Shot	Palliser, formerly shell	Studded	I*	790	8	11	12	17	3½	819
			II	790	8	11	12	17	3½	819
			III	788	4	11	14	17	3½	817
		Studless	I	793	11½	8	10	15	10½	818
			II	794	2	8	3	15	10½	818
	Case		III	—		—		—		805

The bursting charge of Common Shell is L.G., that of Shrapnel Shell is F.G. Palliser Shot, formerly shell, are weighted with salt in place of a bursting charge.

Gas-checks.

(*List of Changes*, §§ 3374, 3863, 4116, 5062.)

Plate XV.

Fitted with plug and nut, Marks I and II .. 17 lb. $3\frac{1}{2}$ oz.
Automatic, Marks I and II .. .. .. 15 lb. $10\frac{1}{2}$ oz.

The *gas-checks fitted with plug and nut* are for use with studded projectiles. Mark I are ordered to be returned as opportunity arises, and will become obsolete. Mark II differs from it in having projections to fit the grooves of the gun. The Mark II plug differs from Mark I in having a shoulder on it to prevent the nut from binding on the gas-check, which is, therefore, just sufficiently free to revolve, and to facilitate loading. The Mark II nut is not so thick as the Mark I, not being required to screw down on the shell to protect the plug when the shell is stored without gas-check.

Shells of earlier patterns, which have been altered to take gas-checks, and which are distinguished by being stamped with a * after the mark numeral, require shorter plugs than those suitable for shells of the latest patterns. In all demands for such plugs and their nuts, therefore, the distinguishing mark of the shells for which they are required (I, I*, II, II*, or as the case may be) will be specified after the proper vocabulary designation of the shells.

The *automatic gas-checks* are for use with studless shell. They both have projections to suit the grooves of the gun. Mark II differs only from Mark I in being hollowed out behind the projections, so as to expand more readily into the rifling.

Fuzes.

Plates XVIII, XIX, XX.

Present Equipments:—

Time, Wood, 15 seconds, M.L., No. 41, Mark II.
Percussion, General Service, No. 5, Mark II.

The Percussion G.S. is to be superseded by:—

Percussion, Direct Action, No. 3, Mark II.

15-*seconds Fuze.*

The fuze is made of beech wood, with a composition channel bored almost the whole length of the centre of the fuze. This channel is lined with paper, and driven with 2 inches of slow-burning composition. Above this is a 0·75-inch pellet of mealed powder, having a hole bored down its centre to a depth of 0·55 inch. There are six powder channels bored parallel to the composition channel, connected at the bottom by quick-match placed in an annular groove and pressed into the bottom of each channel. The bottom hole is bored through and threaded with quick-match. The numbers on the paper scale are reversed, so that they read correctly when the fuze is being bored. Each side hole is marked on the index paper with a dot of yellow paint, and the whole numbers refer to half seconds and the decimals to quarter seconds. The head of the fuze is closed by a gun-metal plug, round the pin of which quick-match is looped and led through two fire-holes to a groove. This groove is covered by a copper and tape band which must be removed before firing.

(*Fuzes—continued.*)

Boring the powder channels parallel to the composition channel commenced with the 122nd thousand. They were formerly bored parallel to the exterior. The change has reduced the amount of wood through which the bit must pass when the fuze is bored short, and by simplifying this operation it is hoped that the fuze has been rendered more certain in action.

G.S. Fuze.

It is specially designed so as to act on impact, not on graze; it will not explode on a shell passing through a wave, but will explode on the shell striking a wooden ship.

Its construction is shown in the plate.

The body A and top plug B are made of gun-metal; the cone plug C, detonating ball D, and steady plug E are also made of gun-metal, but of a harder alloy to prevent them from altering their shape; the plain ball F is made of brass, and the suspending wire H is made of copper.

The body is conical, tapped throughout with a screw, to screw into the G.S. gauge fuze hole, it is about ·2″ thick, a strong case being essential to resist the shock of a heavy charge. It is slightly hollowed out in the centre to allow sufficient play to the detonating ball, and is also hollowed out at the base to allow the lead cup to dovetail into the recess when it is crushed up. There are two slots cut in the top of the body to allow the fuze to be screwed into the shell, it is tapped at the top to receive the top plug. There is a hole in the centre of the base which serves to allow the cone plug to set back.

The top plug is a small disc having two holes in the upper part to enable it to be screwed into the fuze, and a cup-shaped recess in its lower part, into which the plain ball fits; it is tapped with a screw thread to fit the body.

The plain ball is a small solid ball, turned from brass wire.

The steady plug is a disc, recessed at the top and roughed to receive a ring of detonating composition, and having a cup in the centre to receive the plain ball; three fire holes are pierced through it to allow the flash to pass down. The bottom of the central hole is enlarged to receive the projection of the detonating ball. A detonating composition J is pressed into the recess, and is covered over by a thin copper washer K, which is lacquered.

The detonating ball is roughed by a number of vertical grooves, and has a deep horizontal groove near the centre. These grooves serve to retain the composition with which the ball is coated, and also render ignition certain when the ball strikes against the body. At the top of the ball is a cylindrical projection which fits into the steady plug, and at the bottom is a smaller rounded off projection which fits the cone plug. Over the composition is a layer of thin gut, then two thicknesses of thin silk, then two thin copper hemispheres, and finally another thickness of gut and three thicknesses of silk. Each layer of silk and gut is varnished.

The object of the copper hemispheres and of the copper washer over the steady plug is to bring the sensitiveness of the composition within such limits that the shock of grazing will not explode it, while the shock of direct impact against a solid body will make it act.

The cone plug is pierced by three fire holes, the central one being slightly enlarged to support the detonating ball, the bottom of the plug contains a chamber L, which is filled with mealed powder, driven and pierced like a tube, it is recessed near the top of the cylindrical

part to allow the lead cup M to dovetail on to it, pierced near the base for the suspending wire, and closed at the base by a small cardboard disc.

The lead cup is a hollow cylinder, having a flange on the head to fit the recess on the cone plug.

When the fuze has been put together in a perfectly dry state, the top plug, having its edges coated with a waterproof cement, is screwed in and allowed to stand until the cement sets. The slot holes in the head of the fuze are then carefully filled with cement, the hole in the base is closed by a cardboard disc, and finally the top and bottom of the fuze are coated with cement. These cementing operations secure the fuze from damp—their importance will be seen further on. Fuzes thus secured have been found to resist water when placed in it for some hours.

A label is attached to the top of the fuze, giving the Mark, number of thousand, and date of manufacture.

Suppose a shell fired from the gun, the steady plug, ball, and cone plug set back, on shock of firing, the suspending wire is broken, the lead cup prevents rebound, and the stem of the cone plug protrudes through the base of the fuze, the detonating ball being released from its pivots by the slight wobble of the shell; on striking, the ball, now unsupported, is dashed violently against the side of the body, and explodes the detonating composition, the flash finding exit through the holes in the cone plug to the priming, and thence to the powder in the shell.

Direct Action.

It consists of the following parts, viz., body, cap, screw plug for needle disc, needle disc, screw collar, bottom screw plug, steel needle.

The fuze is made of an alloy resembling gun-metal, with the exception of the steel needle, copper disc, and a few minor portions.

The *body* is tapped on the exterior to the general-service taper and pitch. The lower part is hollowed out to receive a blowing charge of fine powder (75 grains). The bottom is closed by the bottom plug screwed in, as shown in the cut. The upper portion of the body is turned to receive the cap, and is bored out to receive the screw plug for needle disc and screw collar. It is recessed to receive the detonating composition. At the bottom of this recess nine conical fire-holes are bored through the metal separating the upper and lower portions of the interior of the body. A small brass pin is screwed into each side of the body on the exterior, near the top.

The *screw plug for needle disc* is tapped so as to screw into the body, and is recessed. It is slightly coned at the bottom, and has a hole through the centre ·2″ in diameter. Two holes are drilled in the top so as to screw the plug into the fuze. Its upper portion is recessed to hold the needle disc.

The *screw collar* screws into the body over the screw plug, and has slots cut in its upper edges for the purpose.

The *needle disc* is of copper, ·03″ thick, and has a central hole to receive the needle.

The *needle* is of steel, and of the shape shown in the section, having four points. It is soldered to the disc.

The *cap* fits over the top and has a milled edge. On each side a

(*Fuzes—continued.*)

T-shaped slot is cut to fit over the brass pins in the body, and thus to secure the cap to the fuze. A square keyhole is cast in the upper surface, so as to take the G.S. plug and fuze key.

The *bottom plug* is screwed into the bottom. It has a central hole, and two key holes for screwing it in. It is secured and rendered damp-proof by cement and solder.

The exterior of the fuze is lacquered.

The conical holes are filled with meal powder paste, and are covered on the under side with a disc of fine white paper shellaced on.

Three grains of cap composition are pressed by a 600 lbs. pressure into the recess provided for it. It is varnished, and covered with a disc of varnished paper, on the top of which is a copper washer kept in position by being spun over.

Below the fine powder is a disc of red shalloon and one of white paper. They are attached by shellac varnish to the bottom plug.

The fuze, being prepared by simply taking the cap of, is quiescent in all its parts till direct impact takes place, or a graze at such an angle that the nose of the shell enters the ground. When either of these events occurs the needle is crushed down on to the detonating composition, which fires, and ignites the meal powder in the conical holes and the fine grain powder. The flash therefrom blows down into the shell and fires the charge.

The head of the needle being some distance below the head of the fuze, it cannot be touched or forced down on the detonating composition when any ordinary rammer is used for loading.

The cap should not be removed till the moment of loading.

The above is a description of the Mark II fuze. The Mark III differs from it in being slightly longer, the screw thread continued to the top to enable the fuze to be screwed in flush with the top of the shell, in the fuze being closed with a safety plug in place of the cap. With guns loaded hydraulically or by steam power, only this mark of fuze is to be used.

CHARGES.

(*List of Changes*, § 3677.)

Plates XXI, XXII.

Full:— { Mark I gun .. 160 lb. P^2 and 165 lb. $Prism^1$ Black.
„ II „ .. 190 lb. $Prism^2$ or $Prism^1$ Black.

The charges of 160 lbs. P^2 will be used up before the corresponding charges of $Prism^1$ for the Mark I gun are issued.

The original charge for the Mark II gun was 210 lbs. $Prism^2$, and this might still be used with guns mounted on other than 6 ft. recoil platforms; but on account of the violent recoil on these mountings it was reduced to 190 lbs., which gives the same muzzle velocity as the two charges mentioned above, given in Mark I gun; and now, to avoid confusion, it has been lately decided that this 190 lbs. charge shall be adopted for all Mark II guns irrespective of their mountings, so that one range table is common to all 12·5-in. guns.

(*Charges—continued.*)

The charge of 160 lbs. P^2 consists of two cartridges of 80 lbs. each. The cartridge is made of No. 2 silk cloth, and is fitted with a varnished wooden stick down the centre 20·05 inches in length, so as to ensure an uniform space for the charge behind the projectile when rammed home. A strap or becket of silk cloth passing over the head of the stick is sewn on the top of the cartridge for lifting it.

Diameter of cartridge filled ..	..	12 inches.
Length of cartridge, over stick ..	..	20·05 inches.

The charge of 165 lbs. Prism[1] Black consists of two cartridges of 82½ lbs. each. The cartridge bag is made of No. 3 silk cloth with two beckets at each end, and is provided with a hole at each end covered with silk netting, over which is shellaced a disc of red shalloon to which a piece of broad silk braid is attached to remove it by. All these shalloon discs are to be torn off before loading.

The prisms are built up in 20 layers, consisting of 19 layers of 44 prisms each, and 1 layer of such convenient number as will bring the total weight up to 82½ lbs., but the top layer should not be less than 75 per cent. of the number of prisms in a complete layer, one or more prisms being taken from each complete layer to make up the requisite number in the top layer.

Diameter of cartridge filled ..	..	10·9 to 11·5 inches.
Length of cartridge ..	..	19·75 to 20·25 inches.

The charge of 190 lbs. Prism[1] or Prism[2] Black consists of 4 cartridges of 47½ lbs. The cartridge bag is similar to the 82½-lb. cartridge mentioned above. In the case of the Prism[2], the prisms are built up in 5 layers, consisting of 3 layers of 18 prisms, 1 layer of 16, and 1 layer of 12 prisms (the centre column being left out), or with an additional prism on the top tier, if necessary to bring the total weight of cartridge within the limits given below. The corner prisms of each layer are built up so as to preserve the form of cartridge.

The limits of weight are 47⅞ lbs. to 47⅛ lbs.

In the case of the Prism[1], the prisms are built up in 10 layers, somewhat similar to the 82½-lb. cartridge.

Diameter of cartridge filled ..	..	11·95 to 12·25 inches.
Length of cartridge ..	..	10·2 to 10·7 inches.

TUBES.

(*List of Changes*, §§ 3842, 4604, 4762, 5352, 5371.)

Plates XXIII., XXIV.

Mark I gun	Friction copper long, Mark II. Friction copper solid-drawn, Mark I.
Mark II gun	Vent-sealing, friction V., Mark IV. Vent-sealing, friction V., drill, Mark II. Vent-sealing, electric V., Marks III. and IV. Vent-sealing, electric V., drill, Mark I.

The *solid drawn friction tube* will supersede the "long" tube, from which it differs in being made of solid drawn copper with a solid head, in being only 2″·075 in length, filled with pistol powder, and closed by a cork plug secured by shellac.

(*Tubes—continued.*)

The *vent-sealing friction tube* is made of cast brass bored and turned, and with the head and projection is about 3 inches long; from it protrudes in the direction of its axis a copper wire about 4 inches in length, which is formed into a loop at the extremity, and is termed the draw wire.

The tube, which fits very accurately in the vent, is 4 inches diameter at its thickest part, and tapers very slightly towards the point. The head prevents the tube being inserted too far in the vent, and is furnished with a groove all round the exterior in which works the extractor. On the exterior of the head is a large cylindrical projection cut completely through by a slot parallel to its axis. This projection acts as a spring and fixes the vent-sealer in the vent-head while the latter is being put in. On the top of this larger projection is a smaller one, through which and through the draw wire passes a fine transverse suspending wire, which retains the parts in position and prevents premature action. The interior of the tube is bored out in two cylindrical cavities of different diameter, the larger being towards the point. Between the two cylinders is a shoulder, and the smaller one terminates towards the head in a coned seating. The draw wire passing through the head is screwed into a brass cone which is free to move along the smaller cylindrical boring, and which when pulled back fits exactly into the sealing at the end. Into the front of this cone is fastened the friction bar, which is roughened as usual. This passes through two copper washers, which are larger in diameter than the smaller cylindrical borings, and are about ·15 inches beyond the shoulder. Outside these washers the friction bar is covered with detonating composition, which is retained in its position on the bar by means of an oval copper tube and a disc of shellac'd paper. The remainder of the tube is filled with F.G. powder and closed with a disc of varnished cork lined with paper.

Action.—On pulling the lanyard the suspending wire is sheared, and the draw wire, cone, washers, &c., move to the rear until the washers are brought up by the shoulder, when the friction bar is drawn through the oval copper tube and fires the detonating composition. The explosion of the powder fires the charge, and at the same time expands the tube so as to make it fit very tightly in the vent in which it is retained by the vent-head. This prevents any escape between the two, while the brass cone, being tightly pressed into the corresponding seating at the end of the tube, securely seals the joint and prevents any escape of gas through the interior.

The *drill friction tube* is of solid brass similar in external form to the service tube. The head is fitted with a steel wire about $3\frac{1}{2}$ inches in length, having a steel friction loop.

The *Electric tube*, Mark III, is similar in shape and made of the same material as the friction one, but there is no smaller projection on the head for the shearing wire, and the draw wire is replaced by two insulated copper wires about 18 inches long, twisted together and terminating at one end in spirals which are tinned inside and insulated on the exterior so as to form convenient means of attachment to the wires from the battery. At the other end they pass through the head of the tube in the direction of its axis, being secured outside by frappings of oiled silk and thread, and inside by cobbler's wax, and the bared ends are soldered respectively into the two halves of a brass cone, which is split longitudinally, and the two halves insulated from each other by a piece of asbestos paper, and the whole from the body of the vent-

(*Tubes—continued.*)

sealer by an ebonite tube. In the front of these half-cones are soldered two short copper wire terminals of unequal lengths, which are connected by a diagonal bridge of platinum silver wire. The terminals and half-cones are prevented from shifting, and so breaking the bridge, by two millboard washers placed next the cone, and through which the terminals pass. The bridge is surrounded by a priming of mealed powder and guncotton dust contained in the ebonite tube, which is prolonged beyond the cone for that purpose, and closed with a paper disc. The larger portion of the tube is filled with F.G. powder and closed with a disc of paper and varnished cork. Mark IV tube differs in having the wires and poles coated with tin, and in having the bridge attached to the poles with pure tin instead of soft solder.

Action.—On a current of electricity being sent down the wires, it traverses the bridge, raises it to incandescence, and fires the priming, the powder, and the charge.

The *electric drill tube* is solid, of similar form and dimensions to those of the service tube. A gun-metal tube having two escape holes, with fine white paper pasted over them screws on the top, the other end of the tube has a similar screw to receive an ebonite plug, so that the ends are interchangeable. Two copper wires pass through the plug, the ends projecting inside to form the poles. These are connected by a bridge of platinum silver wire soldered to them, offering an electrical resistance of 1·65 ohms. The wires outside are insulated with silk and covered with shellac, and terminate in small brass sockets. The tube is issued empty, and when required for use it will be charged with a small quantity of priming composition.

INSTRUCTIONS FOR THE PREPARATION OF SHELLS.

(*Regulations for Magazines, &c.*, 1887.)

Fixing Gas-Checks.

Studded Projectiles, with Plug and Nut.

Unscrew and remove the nut with the "spanner gas-check nut," then apply the "Wrench, base plugs" to the gas-check plug, and screw it well up in the direction of the arrow* to insure its being well home.

If when unscrewing the nut, there is any tendency for the plug to unscrew also, the "Wrench, base plug," should be at once applied to the head of the plug and turned in the direction of the arrow, at the same time as the nut is being turned in the opposite direction.

Place the gas-check on the base of the projectile with the concave, or unpainted side, next the base, then screw the nut on to the end of the plug with the "spanner, gas-check nut." With Mark I, gas-check, plug and nut, the nut must bind against the gas-check. With Mark II, gas-check, plug and nut, the nut will be screwed down to the shoulder on the plug.

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* The heads of the gas-check plugs, and the wrought-iron nuts, will each be stamped with an arrow to show the direction in which to turn, either when screwing in the gas-check plug, or when screwing on the wrought-iron nut.

(Instructions for the Preparation of Shells—continued.)

Studless Projectiles with Automatic Gas-Checks.

These gas-checks become fixed to the projectile when the gun is fired. They can either be loaded separately or attached to the projectile before loading. When it is required to attach the gas-check before loading, place it on the base, and strike it with a pointed hammer or chisel so as to make an indent at two or three points in that part which surrounds the neck of the projecting base of the projectile. They are, however, as a rule, loaded separately.

An automatic gas-check will be issued for all guns for which they are authorised for drill purposes. It must be firmly nicked on the shell, as otherwise it cannot be extracted. Care must be taken—

a. That the gas-check is not injured, and that it is at all times free from burrs.

b. That the drill cartridge is sufficiently long to prevent the gas-check from jamming in the end of the grooves.

Filling and Securing Shells.

Common, Studded.

Remove the plug from the fuze hole, place the filling rod in the bag, insert it through the fuze hole, taking care not to force the end of the rod through the bottom of the bag; carefully push in the bag until the neck only is in the fuze hole, a portion being kept outside, as the whole bag must not be allowed to slip into the shell during the operation of filling; then withdraw the rod and insert the funnel in the neck of the bag, pressing the funnel well down into the fuze hole; pass the filling rod down through the funnel and gradually pour in two or three pounds of powder; take out the funnel and rod, lift up the bag and jerk it, so as to "set" the powder well down to the bottom, and to open the bag. Then re-insert the funnel and rod as before and continue the filling.

The filling-rod should be moved up and down to facilitate the passage of the powder through the funnel; the powder should be firmly pressed upon all over, and the rod should not be forced against the bag. A steady pressure is necessary to fill the shell, and this should be frequently applied; no great amount of force should be used.

When the shell is full, withdraw the funnel and filling rod, and tie the neck of the bag with twine, close to the top of the fuze hole. A piece of twine is attached to the neck of the bag for this purpose (it must be shifted to its proper position if necessary). Cut off the superfluous choke and push the neck of the bag well down, and to one side of the fuze hole; insert in every shell one "Bags, primer, filled, seven drams," or more if there is room, then screw in the fuze or plug as required, taking care that the fuze hole is clean, and the fuze or plug lubricated.

Common, Studless.

These shell are filled from the base. Place the shell upon its point which may be inserted in a block of wood hollowed out for the purpose, or in any other convenient place. If the shell immediately after filling, is to be used with a wood time-fuze, insert an unservice-

(Instructions for the Preparation of Shells—continued.)

able M.L. wood time-fuze, or a piece of wood of the same size in the fuze-hole before filling; if not, the fuze-hole plug will be sufficient.

After standing the shell upon its point pass the holder, shell, "B.L." or "studless" of the size required over the base, and screw up the bolt, then hold the handles firmly, while another man unscrews the base plug with the "Wrench, base plug." Now drop in three "Bags, primer, filled, seven drams." Place the brass filling-rod inside the bag and insert it in the shell, taking care not to push the rod through the bag, withdraw the rod, insert the copper funnel, and complete the filling as described above for studded common shell.

Shrapnel, Studded or Studless.

Remove the plug from the fuze hole, and after seeing that the fuze hole is clear of any dirt, &c., insert the leather funnel and pour in the bursting charge, pistol, F.G., R.F.G., or R.F.G.^{2} powder which has been previously weighed out or measured. This must be done gradually, for if the whole of the powder is put in at once the tube is liable to become choked. The shell should be tapped on the side with a wooden mallet until the whole of the bursting charge has passed down the tube, taking care that none of the powder is left at the bottom of the socket. Drop in the primer, Shrapnel shell, Mark III, and by means of the Driver, screw, Shrapnel, large, III, screw it tightly into the tube and then screw in the fuze or plug as may be required.

Palliser Shot, formerly Shell.

These projectiles will be filled with sand equivalent in weight to the former bursting charge.

Fixing Plugs and Fuzes.

When plugs or metal fuzes are screwed into shells, they will be lubricated with Field's grease, No. 3; if for use at home stations, or in British North America, Price's composite grease is to be employed at all other stations.

Empty projectiles fitted with plugs and kept in exposed situations where the plugs are liable to become set fast by corrosion from the action of salt water, or otherwise, should have them unscrewed once at least every six months and the threads cleaned and re-lubricated as above.

Instances have occurred in which fuze-hole plugs of common shell have been so jammed in as to be immovable in consequence of using the "wrench, base plugs." The "key, iron, fuze and plugs, G.S.," the "key, plug, G.S.," and the "key, fuze, universal," are the only implements which should be used for screwing in the G.S. plug.

Distinguishing Marks.

All sharpnel shell will be painted with a red tip 1 inch deep.

All filled shells will have a red band $\frac{1}{2}$ inch wide painted round the head $1\frac{1}{2}$ inches from the top; in the case of Shrapnel this band will be $\frac{1}{2}$ inch below the red tip. They will be marked with the date of filling, and also the monogram of the station except when filled by the Royal Artillery.

(Instructions for the Preparation of Shells—continued.)

Filled shells will be marked with the word "Bag," if a bag is used, and with a red disc 1 inch diameter if shalloon primers have been inserted. The colour of the paint will be red on a black ground, or black on a red ground.

Palliser shot (formerly shell) which have been weighted up with sand will have the letter W stencilled in white on the head, and also stamped on the base plug.

Projectiles which are to be used for practice only will be marked with a yellow band $\frac{1}{2}$ inch wide round the body.

Shells which have been emptied will be marked with the letter E in red paint.

Storage of Filled Shells.

Filled studded shells in charge of the Royal Artillery will have the gas-checks attached to them before being placed in the shell store. The shells are to be placed on their bases, resting on the gas-check plugs, and being prevented from falling over by two pieces of wood, 9 inches by 1 inch square, placed one on each side of the nut.

Shells taking automatic gas-checks will be stored unfitted on their bases.

INSTRUCTIONS FOR THE EXAMINATION OF FILLED SHELL.

Common Shell.

Remove the fuze or fuze-hole plug, or the base plug, in the case of studless shell. Take out the bags, primer, with the "hook, G.S., wads," and ascertain they are correct. Draw out the neck of the serge bag by means of the above hook, and untie the twine round the neck of bag. If the powder is in a serviceable condition, tie up the neck of the bag again, and proceed as directed in the instructions for filling. If the powder is caked from the effects of damp, empty the shell (this requires careful manipulation); up-end the shell as required; insert the filling rod or any suitable-sized piece of brass wire so as to facilitate the exit of the powder, and to prevent the bag from doubling up, &c., until the whole of the powder is extracted. Take out the bag, and, if it is in a serviceable condition, replace it in the shell; if not, insert a new bag, and refill with serviceable powder, the bags, shalloon, primer, if serviceable, being also replaced. If the powder is so caked that it will not run out of the shell, fill the shell with boiling water, and allow it to stand for about 5 minutes, then pour out the water, and fill up again with boiling water. After standing for 15 minutes more, the shell may be emptied, using the copper scraper for shells to facilitate the removal of the wetted powder. The scraper must not be applied until after 15 minutes have elapsed after the second quantity of boiling water has been poured in. When the shell is perfectly dry refill with serviceable powder.

(Instructions for the Examination of Filled Shell—continued.)

Shrapnel Shells.

Remove the fuze-hole plug, unscrew the primer with the "driver, screw, Sharpnel, large, Mark III," and lift out the primer with the "pincers, Shrapnel primer;" turn the shell nose downwards, and if the powder charge flows out and is serviceable, refill and replace primer and plug; the shell should be well shaken if the powder does not come out quite freely, as a portion of the powder may possibly be jammed in the tube; if the powder cannot be extracted as above, being caked from the effects of damp, &c., the primer and plug will be replaced, and steps taken for the exchange of the shell.

NOTE.—If means are available, a wooden horse placed over the open mouth of an empty powder barrel should be used when emptying shells by up-ending them; and for shells filled with powder in bags, a piece of metal tubing, or a piece of sheet copper, rolled up into a tube as large in diameter as can be inserted through the neck of the bag, will greatly facilitate the extraction of the powder.

INSTRUCTIONS FOR THE PREPARATION AND FIXING OF FUZES.

15 *Seconds M.L.*

These fuzes are prepared for any desired time of flight by boring through the side-hole corresponding to the required time into the composition. Place the fuze in the hook of the hook-borer in the proper position for boring the required hole; enter the bit into the side-hole, screwing up until the bit has entered as far as the borer will allow, taking care to press the fuze with the fingers so as to ensure its bedding fairly in the hook.

Unscrew, and when the bit is quite clear, remove the fuze from the hook.

The length of the bit is so regulated that, when placed in the handle, it will enter sufficiently far into the composition when screwed down to the shoulder. If the bit should become unserviceable the handle must be detached from the shank and the tightening screw unscrewed, the square hole in the hook being made for that purpose. Care must be taken when substituting another bit that it is properly placed in the handle, and that the tightening screw firmly presses upon it, for if any space be left between the handle and the head of the bit, the end will not enter a sufficient depth into the composition. The borer should be occasionally examined and cleaned. The operation of preparing the fuze and fixing it in the shell takes, on an average, about 15 seconds; with a little practice these operations may be performed in a shorter time. The fuze is fixed in the fuze-hole by screwing it round by hand until it is held firmly in the fuze-hole; this operation should be performed fairly and not so as to injure the top of the fuze; the fuze must not be uncapped until the shell is placed in the muzzle of the gun. The fuze is "uncapped" by taking hold of the small end of the copper band, which is left exposed, and unwinding from left to right smartly, so as to thoroughly detach the band from the head of the fuze and to leave the priming fully exposed.

If it is required to extract a fuze apply the extractor fuze and unscrew.

(Instructions for the Prepartion and Fixing of Fuzes—continued.)

Middle Time and Percussion.

This fuze is screwed into the shell, before being set, by the "key, fuze, universal," using the semicircular arm with the small projection on it which fits into a hole in the body of the fuze. To set the fuze to act for time only, loosen the nut with the "key, fuze, universal," and turn round the composition ring with which the dome will move also, until the required graduation on the ring is opposite the arrow-head on the body, and clamp the nut. At the moment of loading, withdraw the upper safety pin, which will be found protruding from the dome. If the fuze is required to act as a percussion fuze only, take out the lower safety pin, which will be found in the body of the fuze. If the fuze is to be set for double effect, set the time arrangement as above, and pull out both safety pins.

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Pettman's G.S.

The G.S. fuze requires no preparation; it is simply screwed firmly into the fuze-hole by means of the "key, fuze and plug, G.S." or the "key, fuze, universal."

Direct Action.

These fuzes requires no preparation except the removal of the metal cap of Marks I and II or plug of Mark III. They are screwed firmly into the fuze-hole by means of the "key, plug, G.S.," or the "key, fuze, universal." This cap of Marks I and II is fastened on to the head of the fuze by two double bayonet joints, which enable the cap to be used either in fixing or unfixing the fuze. The cap can be removed by bringing the centre of the bayonet joints in line with the studs on the side of the head of the fuze. The cap or plug is not to be removed until just before entering the shell into the breech of the gun.

INSTRUCTIONS FOR MAKING UP CARTRIDGES.

Care will be taken to see that all cartridge bags are thoroughly dried before being filled.

P^2 Cartridge.

The stick will be secured to the cartridge bag just before filling, by choking the bottom end internally round one end of the stick with broad braid; the bag will be turned inside out, and a needle threaded with broad braid will be run through the bottom end, in the part marked by a printed line, so as to bring it into plaits, then draw up loosely and arrange the plaits so as to lie uniformly in the grove on the end of the stick; draw the braid tight, bring both ends half round the stick, and tie with half a reef knot, then half round again, and tie with half a reef knot, and once more and finish with a reef knot. This braid will be found already threaded through the bottom end for the choke in all empty cartridges issued from Woolwich.

The bag will then be turned back (ready for filling), and, the stick being set upright, an "apparatus, filling cartridges, 12·5 inch, cartridge with stick," will be placed on the top thereof, and the bag will be drawn round the ring of the apparatus.

(Instructions for Making up Cartridges—continued.)

The powder charge will then be inserted, care being taken that it is filled in uniformly round the stick so as to preserve the proper shape of the cartridge.

The cartridge being filled, the apparatus will be withdrawn, the stick being kept steadily in the centre and the cartridge choked at the front end with becket attached, round the head of the stick, with broad braid. The braid is first run through and drawn tight into the groove (as described above), and passed round once and tied; the becket is then placed in its position, and the ends of the braid brought round over the becket and tied with a half reef knot; this will be repeated three times, each turn being tied with a half reef knot, the last being a complete reef knot, and the ends of the braid cut off. The loop of the becket when laid down must not reach within half an inch of the outside of the cartridge.

The surplus cloth at the choke must be trimmed off to a length of about $1\frac{1}{4}$ inches beyond the end of the stick.

The cartridge will be made up to its proper length and diameter by means of the hoops:—

Draw the braid through the silk cloth until the knot of the loop comes home to the cartridge, the single end being already passed through the loop from underneath; pass the single end to one side of and under the loop, then draw the hoop tight and keep it so by placing the forefinger of the left hand firmly on the loop and draw tight the single bend thus formed, *taking care that the bend bites on the loop and not on the single end*, otherwise the knot will slip. The maintenance of the proper form of the cartridge depends on the hooping being thus secured. The superfluous ends of the hoops are then cut off.

Whenever the powder is of a denser description than usual, the cartridges will be brought to their proper length by having the hoops drawn in very tightly; the ribs formed in those parts where the hoops are in the interior of the cartridge will, however, be found to project to about the regulated diameter.

All cartridges will be very carefully examined, and gauged as to length and diameter previous to packing.

Prism.[1] *Cartridges.*

These cartridges are made up as follows:—The prisms are built up by hand in a zinc envelope open at both ends, having as many sides, and being of the same length as the finished cartridge, fitted with a movable wooden bottom, secured by three screws: the envelope is placed on a pedestal less in diameter than itself and filled with the required number of prisms; the bag is then pulled downwards over the cylinder, and the screws holding the wood bottom taken out and the envelope drawn down from between the prisms and bag; the bag is then held down tightly over the prisms while the braids are being secured, commencing with the bottom braid, hooping being performed as mentioned above. The cartridge is then reversed, and after the wood bottom is taken out, it is placed on the scales, and the necessary prisms removed from the top layer, or added to it, until the weight is correct. The superfluous cloth is then cut off to within about 1 inch of the top layer of prisms, a few vertical cuts are then made in the overlap, which is turned in and the edge brought flush with the charge. The top is then placed on and secured at each side, and then sewn round with two

(Instructions for Making up Cartridges—continued.)

strands of silk twist. The top and bottom of the cartridge have each a hole in the centre fitted with network, which is covered over with shalloon patches, stuck on with shellac to prevent the powder dust from falling into the package containing the cartridge.

As it is found in cartridges filled with Prism.[1] powder, that if the prisms in the top layer are few in number they are liable to be crushed by the weight of the cartridge should it be inverted, the top layer should not be less than 75 per cent. of the number of prisms in a complete layer, one or more prisms being taken from each complete layer to make up the requisite number in the top layer.

These cartridges, if necessary, may be made up, by careful manipulation, without using a zinc cylinder, by building up the prisms on a wooden bottom cut to the same shape as the cartridge.

Prism.[2] Cartridges.

The prisms are arranged in layers on a block of wood, the same shape as the finished cartridge. This block must be placed upon a stand, not greater in diameter than itself, such as an empty zinc cylinder. Two layers of 18 prisms each are arranged in the form of a hexagon with the central prism removed. On the top of the second layer is placed a perforated disc of wood, 0·3 inch thick, saturated with paraffin; three layers are then arranged above the wooden disc, and the cartridge is drawn over the powder from above. To enable the man to get a good grip of the bag, four or five slits about 2 inches long are cut in the mouth of it. Care must be taken that the printing on the side of the bag comes upon a flat side of the powder. When the bag is properly fitted, one man holds the charge while another ties the hoops, commencing at the uppermost end, and working downwards. The wooden block is then removed and the cartridge weighed, and if found light one prism is inserted into the centre of the top, layer. The superfluous cloth is then cut off as in Prism[1]. The top, which has hitherto been detached from the cartridge bag, is now made fast at each corner by a few stitches, and then firmly sewn to the body with two strands with silk twist.

Cartridges after being hooped, as before described, will have the superfluous ends of the hoops cut off.

Reduction of 52½-lb. Cartridges.

52½-lb. cartridges will be reduced to 47½-lb. as follows:—

The silk cloth top of cartridge is to be cut open and six prisms of powder removed from the top, and two prisms from the next tier, to bring the total weight of cartridge within the limits given below.

The corner prisms of each layer are to be retained so as to preserve the form of cartridge.

The top is then sewn on with two strands of silk twist.

The limits of weight are to be as follows:—High, 47⅞ lbs., Low, 47⅛ lbs.

The marking of cartridge 52½-lbs. is to be barred out and 47½ lbs printed on.

Marking Filled Cartridges.

Cartridges will be marked with the nature of powder they contain. A record of powder used in all cartridges with maker's name, lot, and date of filling, will be marked on the package, and will be kept in a book for reference.

(Instructions for Making up Cartridges—continued.)

All cartridges issued from store filled will have the initial or monogram of the station at which they are filled stamped on the bottom end.

The cartridges filled by the Royal Artillery will be distinguished by having no initial letter or monogram stamped on them. This order does not apply to cartridges filled by working parties of Royal Artillery for the Ordnance Store Department.

The following initials and monograms will be used at the several stations mentioned:—

Home Stations.

Alderney	A	Dublin	ꝺN	Pembroke	P
Aldershot	A	Edinburgh	E	Sheerness	S
Chatham	C	Fort George	EG	Tynemouth	T
Chester	HR	Gosport	G	Upnor	U
Cork	ꝺK	Guernsey	GG	Woolwich	W
Devonport	D	Harwich	H		
Dover	VR	Jersey	J		

Foreign Stations.

Barbadoes	B	Hong Kong	HK
Bermuda	B	Jamaica	CJA
Cape Town	CT	Kingston, Canada	K
Ceylon	CN	Malta	M
Gibraltar	GIB	Mauritius	ꝺM
Halifax, N.S.	H	Quebec and Montreal	Q

Finished Cartridges.

All cartridges will be very carefully examined and gauged as to length and diameter previous to packing.

Drill Cartridges.

These are issued complete.

SPECIAL STORES.

An extractor is supplied for removing fired vent-sealers. It consists essentially of a lever with a long and a very short arm, the latter being placed under the slot around the head of the vent-sealer. The claws at the other end of the long arm are for use with guns having vent-masking slides only. As vent-sealing tubes depend partly upon mechanical fit for their efficiency, it is important that the vent should

be kept perfectly clean and free from fouling. For this purpose a bronze rimer is supplied which fits the vent accurately, and will remove any dirt. This rimer will fit all axial-vented guns firing vent-sealing tubes. The friction tube is fired by the ordinary lanyard. The electric tube is fired by a Leclanché battery and a firing key, described below. In order to test electric tubes, a Menotti Test Battery is supplied.

Battery, Voltaic or Galvanic, Leclanché, 3-cell Boat Service, complete (Mark III).

(*List of Changes*, §§ 3728, 3733, 3734.)

Consists of three Leclanché cells contained in a mahogany box, on the outside of which is fixed a firing or contact key, and two terminal binding screws, to which the wires leading to the tube are attached.

One pole of the battery is electrically connected direct with one of the binding screws on the outside of the box; the other pole is electrically connected with the fixed end of the firing key, the current being carried through the contact points of the firing key to the other terminal binding screw on the outside of the box. The lever of the firing key is a spring plate of brass, so fitted that the contacts are kept apart until the handle is pressed down; and in order to prevent this being done accidentally a half-cock arrangement is placed on the side of the firing key. This arrangement consists of a brass sliding bar or bolt with a spiral spring, which must be pulled out and kept out to enable the key to be pressed down to make contact.

Battery, Naval, Test, Menotti, with Galvanometer complete (Mark I).

(*List of Changes*, § 2860.)

Consists of a single Menotti element in an ebonite case and cover, having attached to it a galvanometer of 20 ohms resistance, a contact key, and two terminal binding screws.

One pole is electrically connected direct with a terminal binding screw on the ebonite cover, and the other pole is connected with the contact point of the key; the circuit being carried on through the firing key and galvanometer to the other terminal binding screw on one side of the galvanometer.

A small magnet is supplied for the purpose of steadying the needle of the galvanometer when necessary.

The whole is enclosed in a leather case and cover, with shoulder-strap.

To test an electric tube, connect the leading wires to the two terminals; on the key being pressed down there should be, if the tube is in good order, a vigorous deflection of the needle of the galvanometer.

RANGE TABLE.

Charge, { Mark I Gun 160 P² or 165 Prism Black.
Mark II Gun, 190 Prism Black.

Muzzle velocity, 1442 f.s. | Jump, 5 minutes.

Range.	Elevation.	Angle of descent.	Remaining velocity.	Penetration wrought iron.	50 per cent. of rounds fired should fall within			Time of flight.	Fuze scale for 15 seconds M.L. wood time fuze.	
					Length.	Breadth.	Height.			
yds.	° ′	° ′	f.s.	ins.	yds.	yds.	ft.	secs.	yds.	fuze.
0				17·5						
100	0 3	0 9	1,430	17·3	19	0·04	0·1	0·21	260	1·0
200	0 11	0 18	1,418	17·1	19	0·08	0·3	0·42	345	1·5
300	0 19	0 26	1,406	17·0	19	0·11	0·4	0·63	430	2·0
400	0 27	0 35	1,395	16·8	19	0·15	0·6	0·85	515	2·5
500	0 36	0 44	1,383	16·6	19	0·19	0·7	1·00	600	3·0
600	0 45	0 54	1,372	16·5	19	0·23	0·9	1·28	685	3·5
700	0 54	1 4	1,361	16·3	19	0·27	1·0	1·50	770	4·0
800	1 3	1 14	1,350	16·2	19	0·31	1·2	1·72	855	4·5
900	1 12	1 24	1,339	16·0	19	0·35	1·4	1·94	940	5·0
1,000	1 21	1 34	1,328	15·9	19	0·39	1·6	2·16	1,020	5·5
1,100	1 30	1 44	1,317	15·8	20	0·43	1·8	2·39	1,105	6·0
1,200	1 40	1 55	1,307	15·7	20	0·48	2·0	2·62	1,185	6·5
1,300	1 50	2 6	1,297	15·5	20	0·52	2·2	2·85	1,270	7·0
1,400	2 0	2 17	1,286	15·4	20	0·57	2·4	3·08	1,350	7·5
1,500	2 10	2 28	1,276	15·3	20	0·61	2·6	3·32	1,430	8·0
1,600	2 20	2 39	1,266	15·1	20	0·66	2·8	3·56	1,515	8·5
1,700	2 30	2 51	1,257	15·0	20	0·70	3·1	3·80	1,595	9·0
1,800	2 40	3 3	1,247	14·9	20	0·75	3·3	4·05	1,675	9·5
1,900	2 50	3 15	1,238	14·8	20	0·80	3·5	4·29	1,755	10·0
2,000	3 0	3 27	1,228	14·7	20	0·84	3·7	4·55	1,835	10·5
2,100	3 10	3 39	1,219	14·5	20	0·89	3·9	4·80	1,910	11·0
2,200	3 20	3 51	1,210	14·4	20	0·95	4·1	5·05	1,990	11·5
2,300	3 30	4 3	1,201	14·3	20	1·0	4·3	5·31	2,070	12·0
2,400	3 40	4 16	1,192	14·2	20	1·0	4·6	5·57	2,150	12·5
2,500	3 50	4 29	1,183	14·0	21	1·1	4·9	5·83	2,225	13·0
2,600	4 0	4 43	1,174	13·9	21	1·1	5·2	6·09	2,305	13·5
2,700	4 11	4 57	1,166	13·8	21	1·2	5·5	6·36	2,385	14·0
2,800	4 22	5 12	1,159	13·7	21	1·2	5·8	6·62	2,465	14·5
2,900	4 33	5 27	1,149	13·6	21	1·3	6·1	6·88	2,540	15·0
3,000	4 44	5 42	1,141	13·5	21	1·3	6·4	7·15	2,620	15·5
3,100	4 55	5 57	1,133	13·3	21	1·4	6·8	7·41	2,695	16·0
3,200	5 7	6 13	1,126	13·2	22	1·5	7·1	7·68	2,775	16·5
3,300	5 19	6 29	1,118	13·1	22	1·5	7·5	7·94	2,850	17·0
3,400	5 31	6 46	1,110	13·0	22	1·6	7·9	8·21	2,925	17·5
3,500	5 43	7 3	1,103	12·9	22	1·7	8·2	8·48	3,000	18·0
3,600	5 55	7 20	1,096	12·8	22	1·7	8·6	8·75	3,075	18·5
3,700	6 8	7 37	1,089	12·7	22	1·8	9·0	9·02	3,150	19·0
3,800	6 21	7 54	1,082	12·6	22	1·9	9·4	9·30	3,225	19·5
3,900	6 34	8 11	1,075	12·5	23	2·0	9·7	9·58	3,300	20·0
4,000	6 47	8 29	1,068	12·4	23	2·0	10	9·86	3,375	20·5
4,100	7 0	8 47	1,062	12·4	23	2·1	10	10·1	3,450	21·0
4,200	7 14	9 5	1,056	12·3	23	2·2	11	10·4	3,525	21·5
4,300	7 27	9 23	1,050	12·2	23	2·3	11	10·7	3,600	22·0
4,400	7 41	9 41	1,044	12·1	24	2·3	12	11·0	3,675	22·5
4,500	7 54	10 0	1,038	12·1	24	2·4	12	11·3	3,750	23·0
4,600	8 10	10 19	1,033	12·0	24	2·5	13	11·6	3,825	23·5
4,700	8 23	10 38	1,029	11·9	24	2·6	14	11·9	3,900	24·0
4,800	8 37	10 58	1,024	11·8	24	2·7	14	12·2	3,975	24·5
4,900	8 50	11 18	1,020	11·8	25	2·8	15	12·5	4,050	25·0
5,000	9 4	11 38	1,016	11·7	25	2·9	15	12·8	4,125	25·5
5,100	9 18	11 59	1,012	11·7				13·1	4,200	26·0
5,200	9 32	12 20	1,008	11·6				13·4	4,275	26·5
5,300	9 46	12 42	1,003	11·5				13·8	4,350	27·0
5,400	10 1	13 4	999	11·5				14·1	4,420	27·5
5,500	10 16	13 26	995	11·4				14·4	4,495	28·0
5,600	10 31	13 49	991	11·4				14·7	4,570	28·5
5,700	10 46	14 12	986	11·3				15·1	4,645	29·0
5,800	11 2	14 36	981	11·3				15·4	4,720	29·5
5,900	11 18	15 0	977	11·2				15·7	4,790	30·0
6,000	11 34	15 25	972	11·2				16·1		

Drill with Gun on a Casemate Traversing Platform.

The Detachment consists of 17 *Nos. and falls in Two deep.*

To Tell Off.

Officer.	*No.* 1.
Tell Off.	

At "*Tell Off*" No. 1 (who is on the left of the front rank) takes a pace to his front, turns to his right, and numbers himself 1; the right hand man of the rear rank numbers 2; the right hand man of the front rank 3, and so on. After the detachment is told off, No. 1 falls in again on the left of the front rank.

The detachment is marched into the casemate and halted in line, facing the shield, and to the left rear of the platform. The detachment is now in the position of "detachment rear."

To take Post under Cover.

Officer.	*No.* 1.
Take post under cover.	*Right turn.* *Double March.*

The detachment, stepping off, wheels to its left at the left corner of the platform, the front rank filing to the left of the gun, the rear rank to the right; 2 and 3 halting close to the shield and near the port, 4 and 5 forming upon their right and left; 12 on the right of 4, 16 on the right of 12, the whole turning to the right-about together. No. 1 follows in rear of the detachment, keeping under cover as much as possible; 6 and 11 go to the head of the cartridge lift; 7 and 9 to the head of the shell lift; 8 and 14 to the cartridge store; 17 to the foot of the cartridge lift; 10 and 13 to the shell store; 15 to the foot of the shell lift.

General Duties.

No. 1 commands, directs, or superintends the boring and fixing fuzes, assists (if required) to raise projectile, lays and attends to indicator.

No. 2 searches, sponges, assists 3 with cartridge, steadies and guides projectile in raising, rams home, assists 12 to attend to mantlet, and elevates.

No. 3 searches, sponges, loads, hooks, and unhooks hoisting tackle, steadies and guides projectile in raising, uncaps fuze when in bore, attends to port bar, rams home, pumps the running up jack, and assists 11 to attend to mantlet.

No. 4 attends to side arms and supplies them to 2, rams home, and traverses.

No. 5 supplies 3 with automatic gas checks and wedge wads, raises projectile, rams home, attends to snatch block, traverses, and attends to lever of chain-nipping gear.

No. 6 supplies cartridge to 3, raises projectile, and rams home.

(Drill with Casemate Mountings—continued.)

No. 7 attends to fuzes, brings up projectile, raises it, and rams home.

No. 8 attends to cartridge store, and serves out cartridges.

No. 9 assists 7, raises projectile, rams home, and removes empty barrow.

No. 10 attends to shell store.

No. 11 supplies 3 with cartridge, raises projectile, rams home, attends to mantlet and traverses.

No. 12 rams home, attends to mantlet, and traverses. Attends to compressor stop.

No. 13 and 15 supply shells to the lift from the shell store.

Nos. 14 and 17 supply cartridges to the lift from the cartridge store.

No. 16 assists 4 with side arms, rams home, attends to vent and preventor gear, makes ready, and fires.

To Prepare for Action.

Officer.	*No. 1.*
Prepare for action.	*Prepare for action.* *Examine gun.*

"*Prepare for action.*"—No. 1 provides a piece of chalk and fixes sights.

No. 2, elevating wheel, and assists 4 with side arms.

No. 3, hoisting tackle, consisting of double and treble blocks, and handle of running up jack. He removes the muzzle tampeon.

No. 4, side arms.

No. 5, wedge wads and two traversing handles.

No. 6, cartridge cylinder and dummy cartridge for drill purposes, bucket filled, and brush, and two wood cartridge bearers, for use if required.

No. 7, fuzes, fuze and shell implements, and selvagee for slinging projectile. He obtains the fuze boxes from 10, satisfying himself as to correctness of fuzes and fuze implements.

No. 8 goes to the cartridge store, and prepares to issue cartridges.

No. 9, transporting barrow and brush, automatic gas checks in box, with lid unscrewed.

No. 10 goes to the shell store and prepares to issue shells, tubes, and fuzes. He examines the shells carefully, cleaning them if necessary and removing burrs from studs; he loosens the fuze-hole plugs of shells that will be first issued.

No. 11, cartridge cylinder and dummy cartridge for drill purposes, brings up rammer ropes when fitted with spring clips.

No. 12 assists 4 with side arms.

Nos. 13 and 15 go to the shell store.

Nos. 14 and 17 to the cartridge store.

No. 16 provides tubes in box, and lanyard, a pricker, and a vent server, for Mark I gun; a rimer, extractor, and spare vent head for Mark II.

Nos. 8 and 10 satisfy themselves that the lamps in the ammunition stores are burning brightly.

Nos. 13 and 14, that the hoisting gear at the shell and cartridge lifts works easily.

(Drill with Casemate Mountings—continued.)

Any irregularity in these respects should be at once reported to No. 1.

The stores having been brought up, or found correct, No. 1 will satisfy himself that the foresights fit properly on the gun, and the deflection leaves of the hind sights work easily. He ascertains that the hydraulic buffer is filled with the proper amount of oil, and that the racers are swept; that the running-up jack, indicator, and clutch lever are in working order; he receives reports from the Nos. responsible of any irregularity or deficiency in connection with the different parts of the gun, carriage, platform and stores, or as regards the ammunition stores, lifts, &c., also sees that the compressor and preventor gear are in adjustment.

2 and 4 place the sponge and rammer in the supports suspended from the roof, the shell extractor and wad hook in rear, so as not to interfere with the working with any of the guns in the battery, and convenient for those for which intended.

2 sees that the elevating gear, 4 that the traversing gear, is oiled and in good working order.

3 examines the bore to see the grooves are free from grit, &c., secures the hoisting tackle to the loading bar, overhauling it until the lower block is at a convenient height for hooking to the selvagee on the projectile. The lower block should then be hooked back to a loop on the left mantlet.

5 ascertains that the lever of chain nipping gear is in working order, and sees that the automatic gas checks are placed in a convenient position.

6 places the sponge bucket clear of the working of the gun.

11 coils down the rammer ropes either side of the gun, and, with 12, sees that the mantlets work easily.

16 places the pricker in the loop on the side of the carriage, examines the vent server and places it in the vent (the loop of the vent server lanyard over one of the sights), straps the tube box round his waist on the right side, coils up the lanyard, and passes the bight of it under the tube box strap; fills his box with friction tubes, which he procures from 10.

"*Examine gun.*"—16 drifts the vent, replaces the vent server; 2 and 3 search the gun after the pricker is withdrawn, 2 supplying himself with the wad hook, and replacing it; 12 elevates until the gun is in a convenient position for loading, and clamps the elevating gear.

With *axial-vented* guns 16 removes plug shutter, by unscrewing it, opens the shutter, by taking the handle in his left hand and pressing it to the left, draws it towards him and swings it round to the left. He then removes the vent head, by taking the handle in his left hand, giving it a quarter turn to the left, and drawing it out clear of the vent. He reinserts the vent head, all being correct, by placing feather in line with the slot and pushing it home, giving it a quarter turn to the right. The shutter is then closed by swinging it round to the right and pushing it home, when it will lock itself.

To Load.

Officer.	*No. 1.*
Range ——yards. *With——load.*	*Trail right or left (if necessary), Halt* *With——load.*

(*Drill with Casemate Mountings—continued.*)

"*Trail right or left.*"—No. 1 adjusts the indicator for traversing; 4, 5, 11, and 12 trail right or left.

The gun is traversed to a convenient position for loading if necessary.

"*Load.*"—No. 1 gives 7 the nature of shell (and length of fuze required), adjusts the tangent sight, and places himself where he can best superintend the service of the gun.

2 moves into position for sponging, receives the sponge from 4, and, assisted by 3, sponges the gun, being careful to observe, with Mark I guns, that the vent server is in the vent. He returns the sponge to 4, assists 3 with cartridges and to steady the projectile in raising and guiding it into the bore. He then receives the rammer from 4 (with right rammer rope attached) and, assisted by 3, steadies the stave until the cartridge and projectile are nearly rammed home, they then fall back on the rammer ropes. The rammer ropes being manned by 4, 6, 12, and 16 on the right, 5, 7, 9, and 11 on the left of the gun. Should "*Not home*" be given by 2, they again stand to the ropes, and force the charge home. At "*Home*" they go under cover; 2 and 3 detach the rammer ropes (if fitted with spring clips), hand them to 11 and 12, spring the rammer; 3 inserts a wedge wad, which is pressed steadily home by 2 and 3, and jammed under the head of the projectile by two smart taps. They then spring the rammer (2 handing it to 4), and go under cover.

3 moves into position, and having fixed the port bar and assisted 2 to sponge, slews to his right, withdraws the first cartridge from the cylinder, placing it on his right shoulder, choke to his front; he then turns left about until his back is towards the muzzle and slides the cartridge from off his shoulder into the bore. He does the same with the second cartridge and receives an automatic gas check from 5, places it in the bore immediately in front of the cartridge, painted side to the rear. The projectile is now brought up on the barrow with selvagee ready fixed; 3 standing clear close to the front of the platform, 5 casts loose the lower block of the hoisting tackle, and 3 hooks it into the selvagee and gives "*Hoist away*," and with 2 steadies and guides the projectile, which is raised by 5, 6, 7, 9, 11, and 1 if necessary, manning the running end of the fall; 3 gives "*High enough*," "*Ease off*," and having, with 2, forced the projectile into the bore, casts loose the selvagee, replacing it in the barrow, and uncaps the fuze. The barrow may be pushed clear by 3 before hoisting. 3 now hooks the left rammer rope, which he receives from 11, and the charge and wedge wad are rammed home in succession, the rammer sprung by 2 and 3, and the port bar unshipped by 3.

4, assisted by 16, hands the sponge to 2 and receives it back from him; he hands him the rammer as soon as the projectile is in the bore, and mans the rammer rope. When the projectile and wedge wad have been sent home, he receives the rammer back from 2, and assists 16 to replace it.

5, as soon as the cartridge is in the bore, hands an automatic gas check to 3,* casts loose the lower block of the hoisting tackle, attends to snatch block, mans the fall in raising the projectile, and the rammer rope in ramming home. When the charge is home he supplies 3 with

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* The automatic gas-check cannot be loaded separately at drill as it could not be extracted. For drill purposes the gas-check must be kept fixed to the drill shell.

(Drill with Casemate Mountings—continued.)

a wedge wad, and hooks the lower block of the hoisting tackle to the loop on the left mantlet.

6, after supplying 3 with cartridge, which he brings up, mans the fall of hoisting tackle and afterwards the rammer rope on the right of the gun. The charge for Mark I Gun is divided into two charges, that for Mark II into four. In both cases the charge is brought up in two cylinders by 6 and 11. A wooden bearer being passed through each lid, they are brought up litter fashion, No. 6 leading. They are placed on the ground, 2 assists 3 to take them out and load. With cartridges for Mark II gun, 3 tears the red shalloon patch off the first cartridge.

7 brings up projectile in barrow with selvagee on, having, when necessary, adjusted the fuze according to No. 1's directions, assists to raise and ram home.

8 issues cartridges.

9 assists 7 to prepare, bring up, and raise and ram home projectile, removes barrow and selvagee.

10 issues shell.

11, after supplying 3 with cartridge, raises and rams home projectile, and attends to the left mantlet and left rammer rope.

12 rams home, attends to the right mantlet and right rammer rope.

N.B.—When rammer ropes fitted with "spring clips" are not in use, they are coiled down between the racers close to the piers by 11 and 12.

13 and 15 work the shell lift.

14 and 17 the cartridge lift.

16 lowers the sponge and rammer in succession from the rope support in the roof of the casemate, and assists 4 to hand them to 2, replacing them with 4's assistance, and mans the right rammer rope. With axial-vented guns he then withdraws the vent head and proceeds to fix a vent-sealing tube in it. This is done by holding the vent head vertically in the left hand, at the same time pressing the catch with the left thumb; the tube is then placed in the vent head, wire first, and the catch released.

To Run Up.

Officer.	*No. 1.*
	Run up. Halt.

"*Run up.*"—12 releases the compressor by raising the weighted lever, holding it up until the carriage has moved clear; when clear, he presses down the lever towards the front of the platform. 3 pumps up the jack until the gun begins to move to the front. 3 checks it if necessary by forcing the lever to the rear. With mountings not fitted with preventor gear, in order that the gun should not be run up violently, No. 3 should lower the rear of the carriage gradually and with care, commencing to lower as soon as the carriage has moved forward about 18 inches, lowering rapidly or not according to his judgment. Should the release valve be external No. 1 attends to it.

When up to the front stops No. 1 gives "*Halt*," and 3 lowers the rear of the carriage as described for checking it. 16 presses down the lever of preventor gear, and hooks a tube to the landyard; 2, 3, 11, and 12 close the mantlets. The clutch gear of the running-back chains should never be used in running up or back when the jack is out of order.

(*Drill with Casemate Mountings—continued.*)

To Lay, Make Ready, and Fire.

Officer.	*No.* 1.
Commence Firing,	*Elevate. Halt.*
or,	*Depress. Halt.*
Fire—Rounds.	*Trail right. Halt.*
	Trail left. Halt.
	No. —— *Ready.*
	No. —— *Fire.*

No. 1 adjusts the indicator for traversing, and then, looking over his sights, gives "*Elevate*," &c., as required. 2 at "*Elevate*" releases the clamping arrangement of elevating gear by lifting the handle of the clamp towards the front; he then turns the hand wheel to the right (or towards the front). At "*Depress*" he reverses the movement of the hand wheel; at "*Under cover*" or "*Ready*" he clamps the elevating arc by pressing the handle down towards the rear. 4, 5, 11, and 12 work the traversing handles, turning them towards the rear for "*Trail right*," the reverse for "*Trail left*."

At "*Ready*" the traversing Nos. remain on the handles, the other Nos. stand clear. 16 places the tube in the vent,* and keeping well in rear so as not to pull it out, stands ready to fire, looking towards No. 1. At "*Fire*" he draws the lanyard strongly towards him without a jerk; he drifts the vent, replaces the vent server and pricker, and coils up the lanyard, placing it under his belt. Should no order to "*Fire*" by the Officer have been given when the gun is laid, No. 1 will give the word "*Under cover*." As soon as the gun has been fired it will be traversed back to a position convenient for loading without any word of command.

With *axial-vented* guns 16 re-inserts the vent head and adjusts the lanyard to the pulleys. 1, before he comes down from the platform, hooks the lanyard to the tube wire.

To Run Back and Unload.

Officer.	*No.* 1.
	Run back. Halt.
	Unload.

At "*Run back*" No. 1 adjusts the indicator for running back; 5 raises the lever of chain-nipping gear until the teeth of the sprocket plates catch in the running-in-and-out chains on the platform, and holds it up (or secures it) until, the gun having been run back, the carriage is lowered on to the platform, after which he forces the lever down until it is held by the catch; 3 works the lever of running-up jack until the rear of the carriage is raised.

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* In the service of guns when the firing number cannot put the tube into the vent without mounting on the platform, this should be done by No. 1; No. 16 handing him the tube with lanyard attached, the other end of the lanyard hanging down the side of the carriage, or, if too long, coiled up and hung on the rear eye-bolt. No. 1 puts in the tube when he has laid the gun, giving the word "*Ready*," he jumps off the platform, and at the word "*No.* ——" (naming his gun), 16 seizes the lanyard and stretches it out, looking towards No. 1.

(*Drill with Casemate Mountings—continued.*)

4, 12, 16, on the right, 7, 9, 11, on the left, work the traversing handles, 12 raises the compressor lever. As soon as the gun is back No. 1 gives "*Halt*," and 3 forces the lever of jack as far to the rear as possible, or (if the release valve is external) he unscrews the release valve, until the rear of the carriage rests on the platform.

No. 1 then adjusts the indicator for traversing.

"*Unload.*"—The gun is unloaded by the same Nos. who loaded it.

To Cease Firing and Replace Stores.

Officer.	*No.* 1.
Cease firing.	*Depress. Halt.*
Replace stores.	*Replace stores.*

The gun is depressed and the stores are replaced by the Nos. who brought them up.

To Form Detachment Rear.

Officer.	*No.* 1.
Detachment rear.	*Outwards turn. Double march. Halt. Front.*

"*Detachment rear.*"—No 1 doubles to the left rear of the platform, faces to the left, and gives the order "*Outwards turn;*" 2, 4, 12, and 16 turn to their left, 3 and 5 to their right.

"*Double march.*"—16 and 5, followed by 12, 4, 3, and 2, wheel to their right and left, and when clear of the platform, to the right and round No. 1's left shoulder, 6, 7, and the remaining numbers coming up into their places; when 2 and 3 have passed him No. 1 gives "*Halt*," "*Front*," and changes his flank by the rear.

To Change Rounds.

Officer.	*No.* 1.
Change rounds.	*Change rounds.*

In changing rounds, 2 becomes 4, 4 1, 1 16, 16 12, 12 11, 11 9, 9 7, 7 6, 6 5, 5 3, and 3 2. Thus the gun floor Nos. only will change rounds. When required for drill the other Nos. will be marched on to the gun floor, the detachment being told off afresh.

Service of Gun in Barbette Battery with Sunken Ways.

The guns are fitted with muzzle derricks and supplied with loading stages.

The running end of the fall of the hoisting tackle is led through an ordinary single 8-inch Bothway block, which is hooked into a permanent eye let into the wall of the parapet.

(*Drill with Casemate Mountings—continued.*)

Two 4-inch snatch blocks are hooked to the loops or eyes on the derrick and the bell ropes of the rammer are passed through them. The snatch blocks are hooked for "*Loading*" by 2 and 3, unhooked by them when the wedge wad has been rammed home, and laid down with the rammer ropes when not in use by 11 and 12, who attend to them. The upper block of the hoisting tackle should be moused with spun yarn.

The service of the guns is the same as for those mounted in casemates and behind shields, with the following exceptions:—

"*General duties.*"—5 attends to muzzle derrick; 7 and 9 attend to loading stage.

"*Prepare for action.*"—5 an 8-inch single Bothway block; 11 two 4-inch snatch blocks, which he hooks on to the derrick; 9 tackle for hoisting projectiles on to loading stage.

2 and 4 place the sponge and rammer on the ground on the right of the gun.

"*To load.*"—5, as soon as the cartridge is in the bore, raises the derrick and overhauls the tackle; after supplying 3 with a wad he rounds in the tackle and throws back the derrick; 7 and 9, assisted by 13 and 15, having placed a projectile on the loading stage, run it under the muzzle of the gun, and after the rammer has been withdrawn from the bore, run the stage back to its former position.

If no crane or derrick is available for lifting projectiles on to the loading stage, they can be rolled on on a plank.

The paragraphs relating to portbar, mantlets, and transporting barrow do not apply to this drill, the barrow being required for conveying projectile to landing stage only.

N.B.—For guns mounted *en barbette* without sunken ways, a transporting barrow is used for conveyance of projectile to the muzzle of the gun, instead of a loading stage.

Drill with Gun on a Small-port Carriage and Traversing Platform.

See "Manual of Artillery Exercises," Part IV, Section 1.

To Tell Off.

Officer.	*No.* 1.
Tell off.	

At "*Tell off,*" No. 1 (who is on the left of the front rank) takes a pace to his front, turns to his right, and numbers himself 1; the right hand man of the rear rank numbers 2; the right hand man of the front rank 3, and so on. After the detachment is told off, No. 1 falls in again on the left of the front rank.

The detachment is marched in to the casemate and halted in line, facing the front, and to the left rear of the platform. The detachment is now in the position of "detachment rear."

(Drill with Small-port Mountings—continued.)

To Take Post.

Officer.	*No.* 1.
Take post.	*Right turn.* *Double march.*

The detachment, stepping off, wheels to its left at the left corner of the platform, the front rank filing to the left of the gun, the rear rank to the right; 2 and 3 halting close to the shield, and near the port; 4 and 5 forming on their right and left; 12 on the right of 4, the whole turning to the right-about together. No. 1 follows in rear of the detachment, keeping under cover as much as possible; 6 and 11 go to the head of the cartridge lift; 7 and 9 to the head of the shell lift; 8 to the cartridge store, 14 and 17 foot of the cartridge lift; 10 and 13 to the shell store, 15 foot of the shell lift; 16, under the heads of the side arms facing to the front.

General Duties.

No. 1 commands, directs, or superintends the boring and fixing of fuzes, assists (if required) to raise projectile, superintends raising and lowering of gun, lays and attends to indicator of friction clutch.

No. 2 searches, sponges, assists 3 with cartridge, steadies and guides projectile in raising, rams home, assists 12 to attend to mantlet, attends to port bar, raises and lowers breech of gun, and elevates.

No. 3 searches, sponges, loads, hooks and unhooks hoisting tackle, steadies and guides projectile in raising, uncaps fuze when in bore, attends to port bar, rams home, pumps running-up jack, assists 11 to attend to mantlet, and pumps the lifting jack.

No. 4 attends to side arms and supplies them to 2, rams home, traverses, and pumps the lifting jack.

No. 5 supplies 3 with automatic gas-checks, wedge wads, raises projectile, rams home, attends to snatch block, traverses, attends to lever of chain-nipping gear, and pumps the lifting jack.

No. 6 supplies cartridges to 3, raises projectile and rams home; works following-up gear on right side in raising and lowering gun.

No. 7 attends to fuzes, brings up projectile, raises it and rams it home; works following-up gear on left side in raising and lowering gun.

No. 8 attends to cartridge store and serves out cartridges.

No. 9 assists 7, raises projectile, rams home, and removes empty barrow; works following-up gear on left side in raising and lowering gun.

No. 10 attends to shell store.

No. 11 supplies 3 with cartridge, raises projectile, rams home, attends to mantlet and traverses; works following-up gear on right side in raising and lowering gun.

No. 12 rams home, attends to mantlet, traverses, and pumps the lifting jack.

Nos. 13 and 15 supply shells to the lift from the shell store.

Nos. 14 and 17 supply cartridges to the lift from the cartridge store.

No. 16 rams home, attends to vent and preventor gear, makes ready, fires, and assists 4 with side arms.

(Drill with Small-port Mountings—continued.)

To Raise the Gun.

No. 1 superintends and names the station to which gun is to be raised.

No. 2 mounts on platform, and works the wheel for lifting breech, raising it inch by inch with the trunnions and receiving instructions from No. 1.

Nos. 3, 4, 5, and 12 work pump handles on respective sides; No. 3 communicates with 2, as trunnions are raised inch by inch.

Nos. 6, 11, 7, and 9 follow up with following-up screws by indicator, receiving directions from No. 1. When the proper station is reached, they screw following-up screws hard up, and the pump Nos. ease off jack. No. 1 must take care that the gun is checked exactly at station required.

To Lower the Gun.

No. 1 directs and sees that No. 2 lowers breech to proper station according to height of gun, also that when the breech is lowered to the proper station the gun is set to 3° elevation, the following-up screws are turned down to requisite station; the weight of gun being taken by the jack. The jack is then eased off and gun lowered at trunnions. No. 2 as gun descends turns elevating wheel.

The gun at "cease firing" should never be left at a lower station than 3 inches, so as to be able to remove jack if it should get out of order.

At the lowest station the gun must never be depressed; in fact, it should never press on the head of the lifting jack.

To Prepare for Action.

Officer.	*No. 1.*
Prepare for action.	*Prepare for action.* *Examine gun.*

"*Prepare for action.*"—No. 1 provides a piece of chalk and fixes sights.

No. 2, elevating wheel, and assists 4 with side arms.

No. 3, hoisting tackle, consisting of double and treble blocks, and and handle of running-up jack. He removes the muzzle tampeon.

No. 4, side arms.

No. 5, wedge wads and two traversing handles.

No. 6 (cartridge cylinder and dummy cartridge for drill purposes), bucket filled, and brush, and two wood cartridge bearers, for use if required.

No. 7, fuzes, fuze and shell implements, and selvagee for slinging projectile. He obtains the fuze-boxes from 10, satisfying himself as to correctness of fuzes and fuze implements.

No. 8 goes to the cartridge store and prepares to issue cartridges.

No. 9, transporting barrow and two brushes, automatic gas-checks in box with lid unscrewed.

No. 10 goes to the shell store and prepares to issue shells, tubes, and fuzes. He examines the shells carefully, cleaning them if necessary,

(Drill with Small-port Mountings—continued.)

and removing burrs from the studs; he loosens the fuze hole plugs of shells that will be first issued.

No. 11 brings up rammer ropes.

No. 12 assists 4 with side arms.

Nos. 13 and 10 go to the shell store.

Nos. 14 and 17 to the cartridge store.

No. 16 provides handles for following-up screws, tubes in box and lanyard, a pricker and a vent server for Mark I gun a rimer, extractor, and spare vent head for Mark II.

Nos. 8 and 10 satisfy themselves that the lamps in the ammunition stores are burning brightly.

Nos. 13 and 14 that the hoisting gear at the shell and cartridge lifts work easily.

Any irregularity in these respects should be reported to No. 1.

The stores having been brought up, or found correct, No. 1 will satisfy himself that the foresights fit properly on the gun, and the deflection leaves of the hind-sights work easily, and that the chase sights are in good order. He ascertains that the hydraulic buffer is filled with the proper amount of oil, and that the racers are swept; that the running-up jack, indicator, and clutch lever are in working order; he receives reports from the Nos. responsible of any irregularity or deficiency in connection with the different parts of the gun carriage, platform, and stores, or as regards the ammunition stores, lifts, &c., also sees that the preventor gear and compressor gear are in adjustment.

2 and 4 place the sponge and rammer in the supports suspended from the roof, the shell extractor and wad hook in rear, so as not to interfere with the working of any of the guns in the battery, and convenient for those for which intended.

2 sees that the elevating gear, 4 that the traversing gear, is oiled and in good working order.

3 examines the bore to see the grooves are free from grit, &c., secures the hoisting tackle to the loading bar, overhauling it until the lower block is at a convenient height for hooking to the selvagee on the projectile. The lower block should then be hooked back to a loop on the left mantlet.

5 ascertains that the lever of chain-nipping gear is in working order, and sees that the automatic gas-checks are placed in a convenient position.

6 places the sponge bucket clear of the working of the gun.

11 coils down the rammer ropes either side of the gun, and, with 12, sees that the mantlets work easily.

16 places the pricker in the loop on the side of the carriage, examines the vent server, and places it in the vent (the loop of the vent server lanyard over one of the sights), straps the tube box round his waist on the right side, coils up the lanyard, and passes the bight of it under the tube box strap; fills his box with friction tubes, which he procures from 10.

"*Examine gun.*"—16 drifts the vent, replaces the vent server, and clamps the elevating gear; 2 and 3 search the gun after the pricker is withdrawn, 2 supplying himself with the wadhook, and replacing it; 12 elevates until the gun is in a convenient position for loading, and clamps the elevating gear.

With *axial-vented* guns 16 removes plug by unscrewing it, opens the shutter, by taking the handle in his left hand and pressing it to the

(Drill with Small-port Mountings—continued.)

left, draw it towards him and swings it round to the left. He then removes the vent head, by taking the handle in his left hand, giving it a quarter turn to the left, and drawing it out clear of the vent. All being correct he reinserts the vent head by placing the feather in line with the slot and pushing it home, giving it a quarter turn to the right. The shutter is then closed by swinging it round to the right and pushing it home, when it will lock itself.

To Load.

Officer.	*No. 1.*
Range——yards. *With——load.*	*Trail right or left if necessary, Halt.* *With——load.*

"*Trail right or left.*"—No. 1 adjusts the indicator for traversing; 4, 5, 11, and 12 trail right or left.

The gun is traversed to a convenient position for loading if necessary.

"*Load.*"—No. 1 gives 7 the nature of shell (and length of fuze required) and adjusts the tangent sight.

2 moves into position for sponging, receives the sponge from 4, and, assisted by 3, sponges the gun, being careful to observe, with Mark I gun, that the vent server is in the vent. He returns the sponge to 4, and, with 3, steadies the projectile in raising and guiding it into the bore. He then receives the rammer from 4 (with right rammer rope attached) and, assisted by 3, steadies the stave until the cartridge and projectile are nearly rammed home, they then fall back on the rammer ropes. The rammer ropes being manned by 4, 6, 12, and 16 on the right, 5, 7, 9, and 11 on the left of the gun. Should "*Not home*" be given by 2, they again stand to the ropes and force the charge home. At "*Home*" they go under cover; 2 and 3 detach the rammer ropes, hand them to 11 and 12, spring the rammer; 3 inserts a wedge wad, which is pressed steadily home by 2 and 3, and jammed under the head of the projectile by two smart taps. They then spring the rammer (2 handing the rammer back to 4), and go under cover.

3 moves into position, and having fixed the port bar and assisted 2 to sponge, slews to his right, withdraws the cartridges from their cylinders one after the other and enters them into the bore. He receives an automatic gas check from 5, places it in the bore immediately in front of the cartridge, painted side to the rear. The projectile is then brought up on the barrow with selvagee ready fixed; 3 standing clear, close to the front of the platform, 5 casts loose the lower block of the hoisting tackle, and 3 hooks it into the selvagee, and gives "*Hoist away*," and, with 2, steadies and guides the projectile, which is raised by 5, 6, 7, 9, 11, and 1, if necessary, manning the running end of the fall; 3 gives "*High enough*," "*Ease off*," and having, with 2, forced the projectile into the bore, casts loose the selvagee, replacing it in the barrow, and uncaps the fuze. The barrow may be pushed clear by 3 before hoisting. 3 now hooks the left rammer rope, which he receives from 11, and the charge and wedge wad are rammed home in succession, the rammer sprung by 2 and 3, and the port bar unshipped by 3.

4, assisted by 16, hands the sponge to 2 and receives it back from him; he hands him the rammer as soon as the projectile is in the bore, and mans the rammer rope. When the projectile and wedge wad

(Drill with Small-port Mountings—continued.)

have been sent home, he receives the rammer back from 2, and assists 16 to replace it.

5, as soon as the cartridges are in the bore, hands an automatic gas check to 3, casts loose the lower block of the hoisting tackle, attends to snatch block, mans the fall in raising the projectile, and the rammer rope in ramming home. When the charge is home he supplies 3 with a wedge wad, and hooks the lower block of the hoisting tackle to the loop on left mantlet.

6, after supplying 3 with cartridge, mans the fall of hoisting tackle and afterwards the rammer rope on the right of the gun.

7 brings up projectile in barrow with selvagee on, having, when necessary, adjusted the fuze according to No. 1's directions, assists to raise and ram it home.

8 issues cartridges.

9 assists 7 to prepare, bring up, and raise and ram home projectile, removes barrow and selvagee.

10 issues shell.

11 brings up cartridge, raises and rams home projectile, and attends to the left mantlet and left rammer rope.

12 rams home, attends to the right mantlet and right rammer rope.

13 and 15 work the shell lift.

14 and 17 the cartridge lift.

16 lowers the sponge and rammer in succession from the rope support in the roof of the casemate, and assists 4 to hand them to 2, replacing them with 4's assistance, and mans the right rammer rope. With *axial-vented* guns he then withdraws the vent head and proceeds to fix a vent-sealing tube in it. This is done by holding the vent head vertically in the left hand, at the same time pressing the catch with the left thumb; the tube is then placed in the vent head, wire first, and the catch released.

N.B.—When rammer ropes, fitted with "spring clips," are not in use, they are coiled down between the racers close to the piers by 11 and 12. With Mark II gun, 6 and 11 bring up the four cartridges in two cylinders, a wooden bearer is passed through each lid, 6 and 11 carry them up litter fashion, 6 leading, and place them on the ground. 2 assists 3 to take them out and place them in the bore; 3 tears off the red shalloon patch from the first cartridge.

To Run Up.

Officer.	*No.* 1.
	Run up. Halt.

"*Run up.*"—No. 3 pumps up the jack until the gun begins to move to the front, checking it if necessary, by easing off the jack slightly. Should the release valve be external, 1 will attend to it; 16 presses down the lever of preventor gear, hooks a tube to the lanyard; 2, 3, 11, and 12 close the mantlets. The clutch gear of the running-back chains should never be used in running up or back when the jack is out of order, except in cases of emergency in action.

(*Drill with Small-port Mountings—continued.*)

To Lay, Make Ready, and Fire, *vide* page 65.

To Run Back and Unload.

Officer.	*No.* 1.
	Run back. Halt.
	Unload.

At "*Run back;*" No. 1 adjusts the indicator for running back; 5 raises the lever of chain-nipping gear until the teeth of the sprocket plates catch in the running-in-and-out chains on the platform, and holds it up (or secures it it until, the gun having been run back, the carriage is lowered on to the platform) after which he forces the lever down until it is held by the catch; 3 works the lever of running-up jack until the rear of the carriage is raised.

4, 12, 16, on right, 7, 9, 11, on left, work the traversing handles, 12 raises the compressor lever. As soon as the gun is back, No. 1 gives "*Halt,*" and 3 forces the lever of jack as far to the rear as possible, or (if the release valve be external) he unscrews the release valve, until the rear of the carriage rests on the platform.

No. 1 then adjusts the indicator for traversing.

"*Unload.*"—The gun is unloaded by the same Nos. who loaded it.

To Cease Firing and Replace Stores.

Officer.	*No.* 1.
Cease firing.	*Depress. Halt.*
Replace stores.	*Replace stores.*

The gun is depressed and the stores are replaced by the Nos. who brought them up.

To Form Detachment Rear.

Officer.	No. 1.
Detachment rear.	*Outwards turn. Double march.*
	Halt—front.

"*Detachment rear.*"—No. 1 doubles to the left rear of the platform, faces to his left, and gives the order "*Outwards turn;*" 2, 4, 12, and 16, turn to their left, 3 and 5 to their right.

"*Double march.*"—16 and 5, followed by 12, 4, 3, and 2 wheel to their right and left, and, when clear of the platform, to the right and round No. 1's left shoulder, 6 and 7 and the remaining numbers coming up into their places; when 2 and 3 have passed him No. 1 gives "*Halt,*" "*Front,*" and changes his flank by the rear.

To Change Rounds.

Officer.	No. 1.
Change rounds.	*Change Rounds.*

In changing rounds, 2 becomes 4, 4 1, 1 16, 16 12, 12 11, 11 9, 9 7, 7 6, 6 5, 5 3 and 3 2. Thus the gun-floor Nos. only will change rounds. When required for drill, the other Nos. will be marched to the gun-floor and the detachment told off afresh.

Service of Gun mounted on Turntable.

When 38-ton guns are mounted on turntables to shift from one port to another, it may be done as follows:—To shift from one port to another at "turntable right" (or left), 2, 3, and 6 attend to the catches; 4, 5, 11, and 12 to the winch of the table. After practice the carriage should be run back to the stops, and the platform left in the centre of the turntable.

Silent Drill.

This is always to be done at practice or inspections, unless smoke, darkness, or some other absolute necessity renders the word of command necessary.

This method possesses the advantage of enforcing silence, and compels the numbers working at the gun to fix their attention on the No. 1 or other number giving the signal.

The preliminary commands and "*Fire*" are given by word of mouth.

Officer.	No. 1.
Prepare for action.	*Prepare for action.*
Examine gun.	*Examine gun.*
Range——yards.	*With——load.*
With——load.	

No. 1 mounts upon the platform and adjusts his tangent scale; the other numbers act as usual.

(No. 3 "*Hoist away.*") No. 3 raises either hand, fingers pointing upwards.

(No. 3 "*High enough.*") No. 3 again raises his hand, and waves it across twice.

(No. 3 "*Ease off.*") No. 3 raises his hand over his head and lowers it quickly.

When the rammer head is adjusted the signal to ram home will be made, if required, by 2 holding up his hand; if the odd Nos. cannot see him (2), 3 must do the same. For "*Home*" the hand is again raised.

For "*Not home,*" the hand is raised and waved across.

(No. 1 "*Run Up.*") No. 1 holds up his right hand, palm to the front.

To Lay, Make Ready, and Fire.

Officer (*Word of Command*).	*No.* 1 (*Signal*).
Fire—rounds,	*Elevate. Halt.*
or,	*Depress. Halt.*
Commence Firing.	*Trail right. Halt.*
	Trail left. Halt.
	Ready.
	No.—— Fire (*Word of Command*).

(Silent Drill—continued.)

(No. 1 "*Elevate.*") No. 1, looking over his sights, holds up either hand, fingers pointing upwards.

(No. 1 "*Depress.*") No. 1 turns his hand, so that the fingers point downwards.

(No. 1 "*Halt.*") He drops the hand to the side.

(No. 1 "*Trail right or left.*") He motions with the hand in the required direction, the arm well back.

(No. 1 "*Halt.*") He brings his arm smartly down to his side.

(No. 1 "*Ready.*") If the firing No. makes ready, No. 1 points to the vent; if No. 1 makes ready he holds out his hand to receive the tube from the firing No.

("*Fire.*") To be given by word of command should no order to fire have been given by the Officer.

(No. 1 "*Under cover.*") No. 1 jumps off the platform, and doubles under cover.

In all respects not above-mentioned the drill is the same as laid down.

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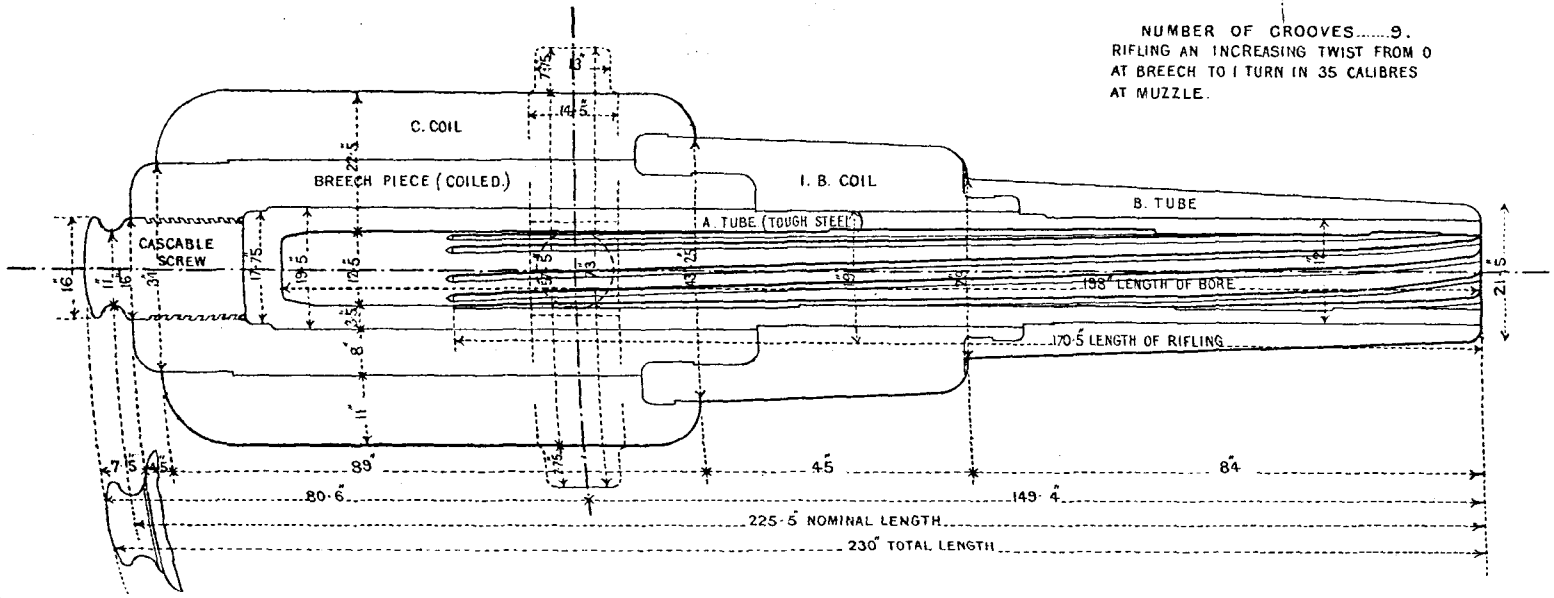
Plate I.

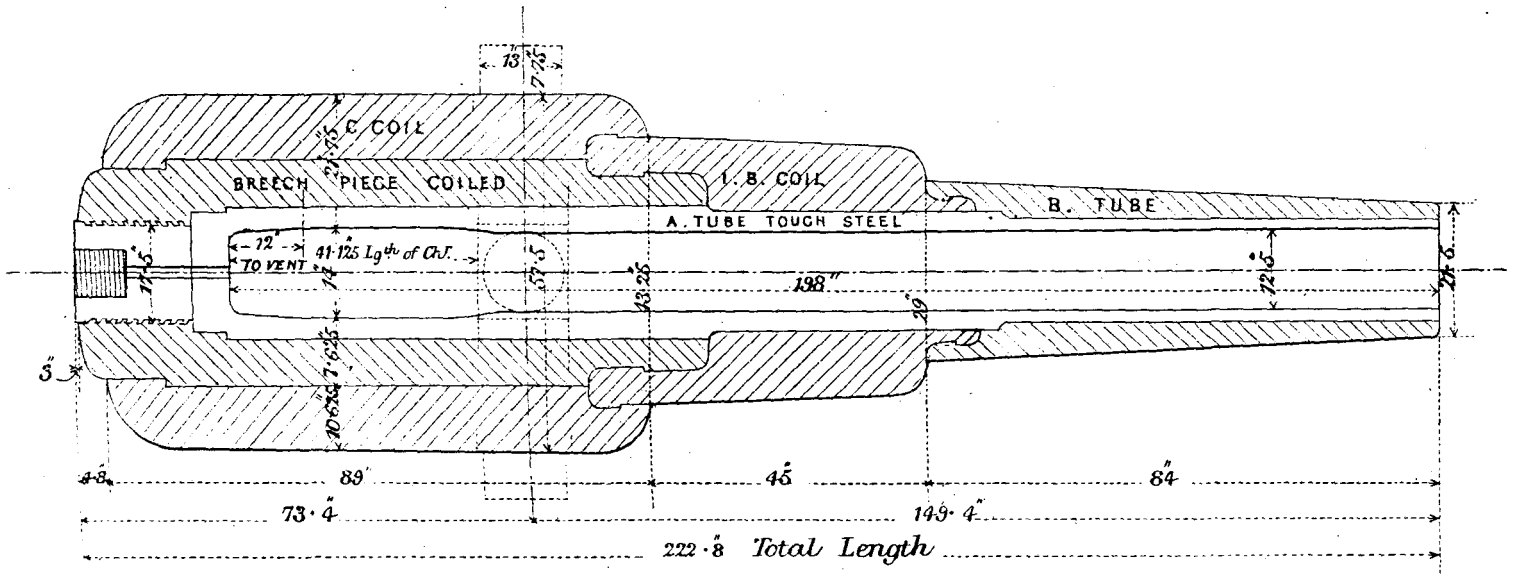
ORDNANCE, WROUGHT IRON, RIFLED, M.L. 12·5 INCH. 38 TONS, MARK I.



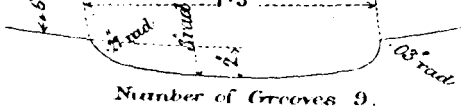
DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN. 930.

Plate II.

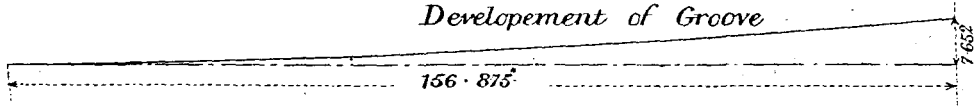
ORDNANCE WROT IRON R.M.L. GUN, 12·5 INCH, 38 TONS. MARK II.



SECTION OF GROOVE
Full size.



Developement of Groove



Rifling an increasing twist from 1 turn in 438 calibres at Breech to 1 turn in 35 cals at Muzzle.

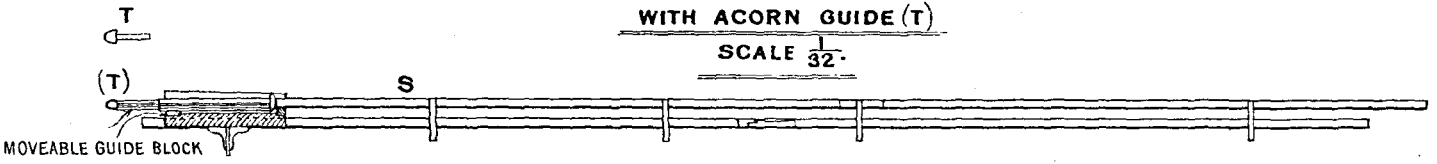
Dangerfield, Lith. 22, Bedford St Covent Garden. 8206

Plate III.

CRADLE VENT.

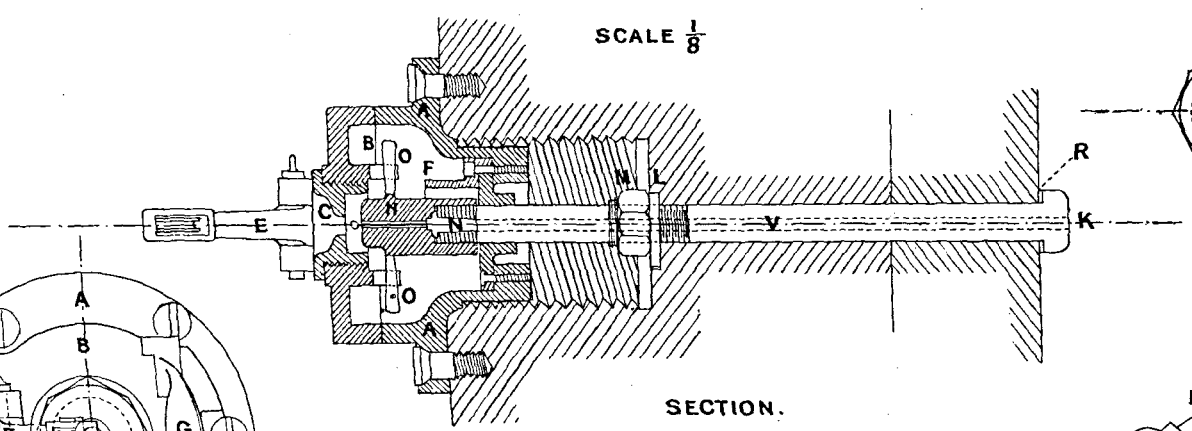
WITH ACORN GUIDE (T)

SCALE $\frac{1}{32}$.

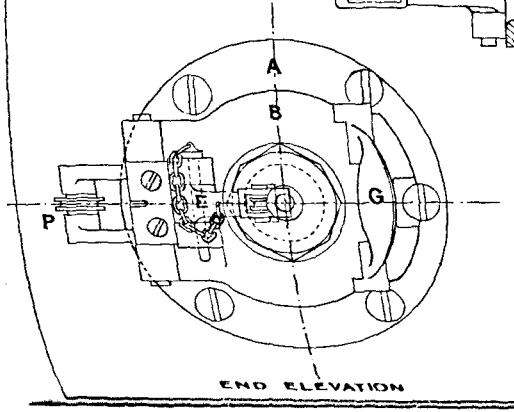


12·5 INCH OF 38 TONS MARK II. AXIAL VENT WITH SHUTTER &c.

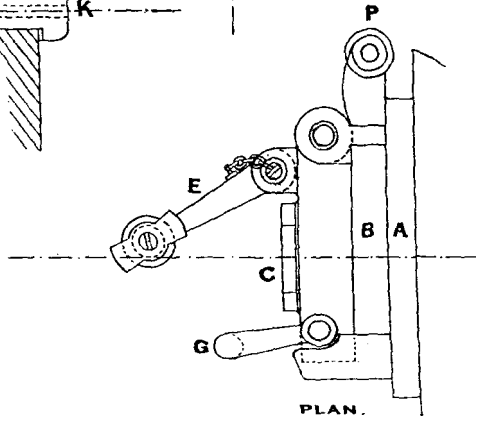
SCALE $\frac{1}{8}$



SECTION.



END ELEVATION



PLAN.

DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN 14868. 9/87.

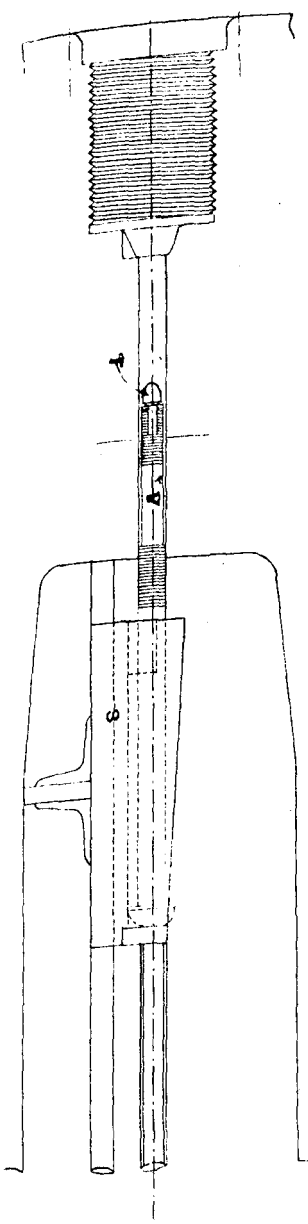
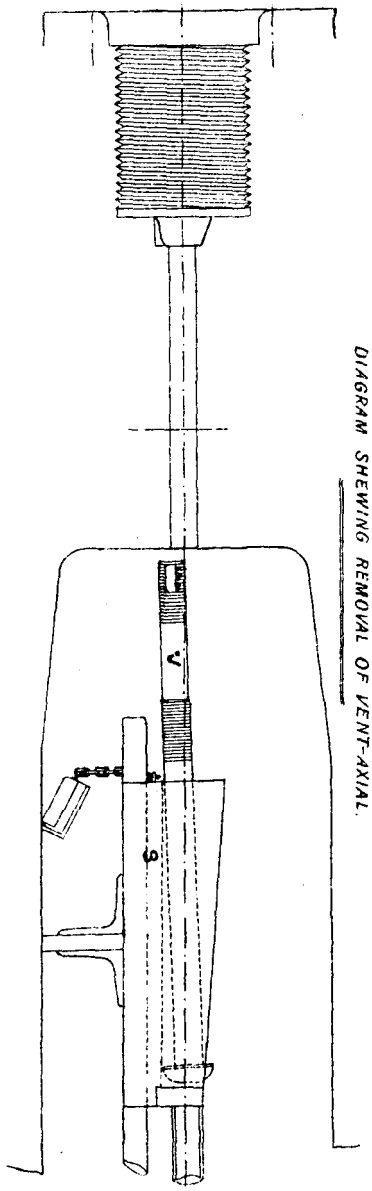


DIAGRAM SHEWING INSERTION OF VENT-AXIAL.



ORDNANCE. R.M.L. 12·5 INCH. MARK II.

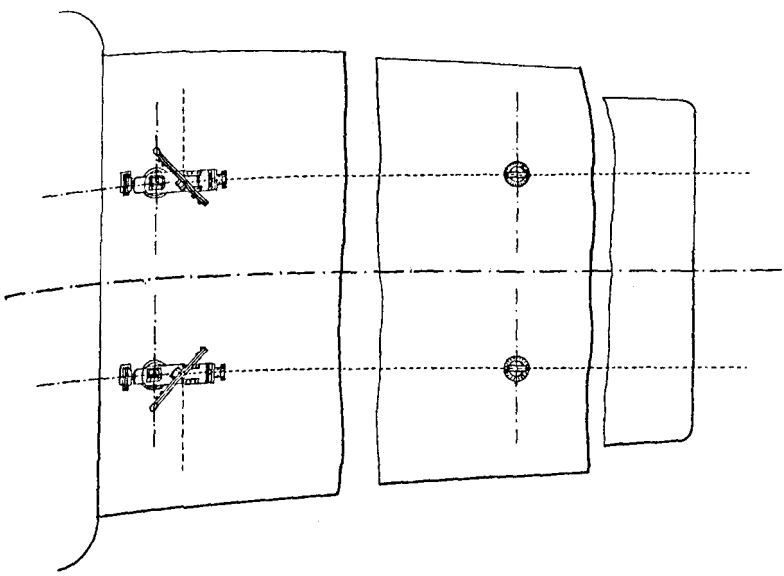
DIAGRAM SHEWING REMOVAL OF VENT-AXIAL.

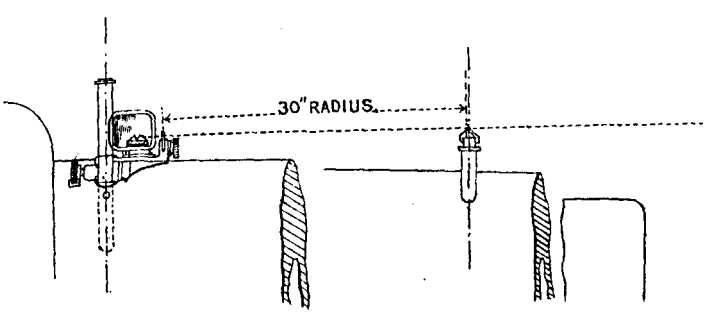
DANCERFIELD LITH 22, BEDFORD ST COVENT GARDEN. 13646 1/87

REFLECTING SIGHTS.

FORE AND HIND,

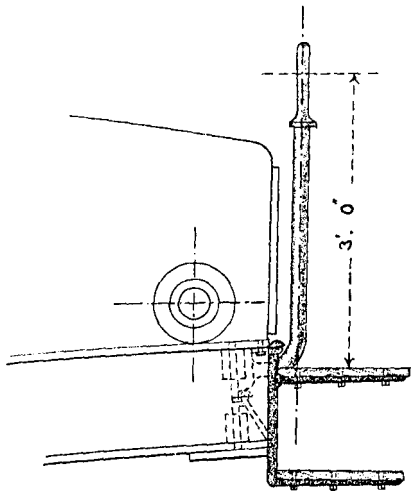
FOR 12·5 IN GUNS ON SMALL PORT CARRIAGES.



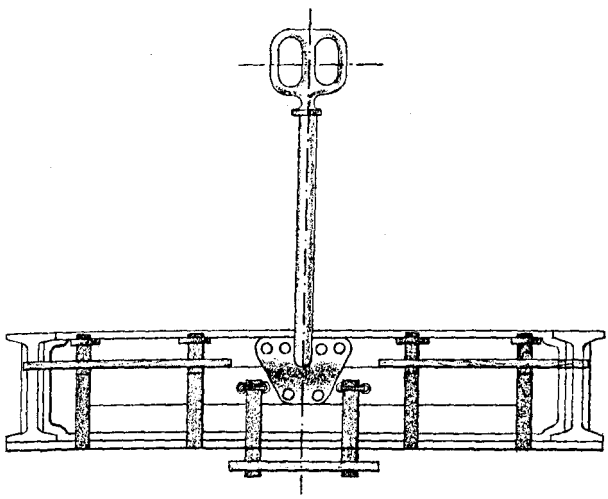


DANCERFIELD, LITH. 22, BEDFORD ST COVENT GARDEN. *14868. 9/87.*

SKETCH SHEWING ATTACHMENT OF POST-HAND AND STEPS-SIGHTING.



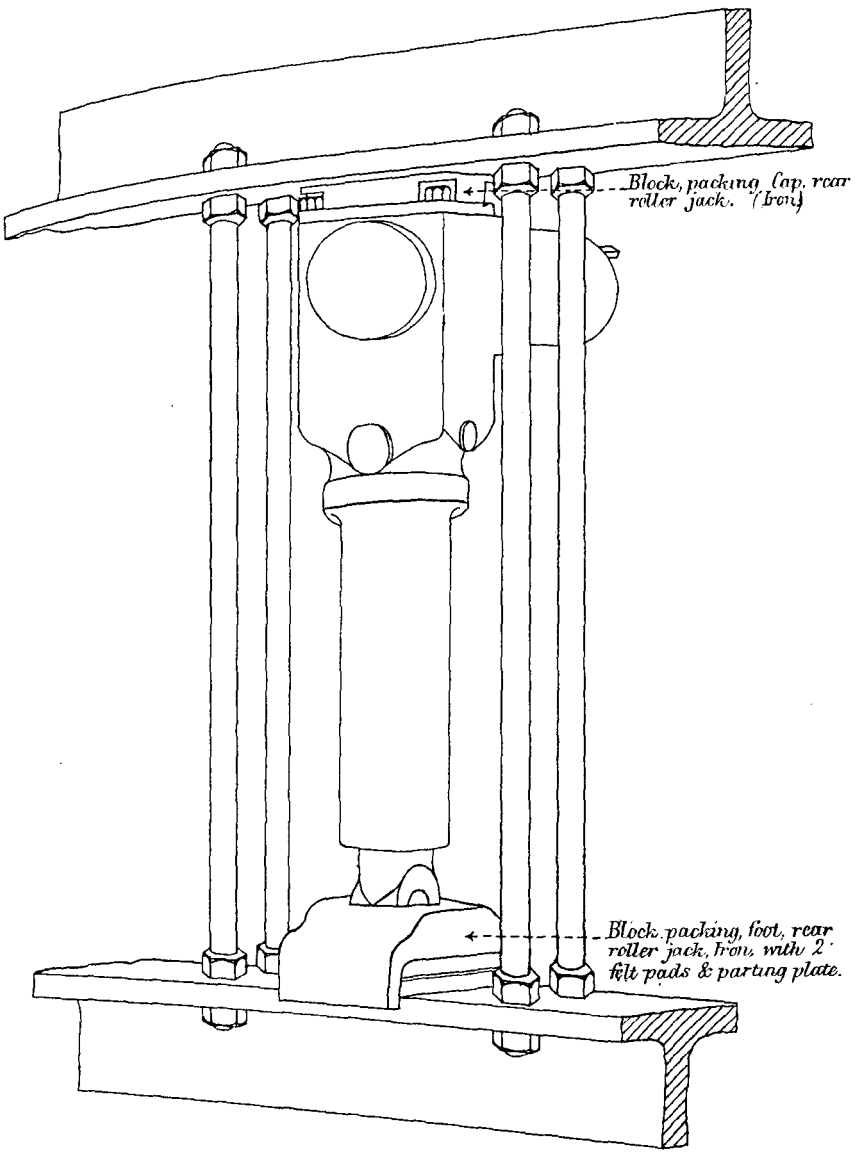
SIDE ELEVATION.



END ELEVATION.

DANGERFIELD LITH. 22, BEDFORD ST COVENT GARDEN. 14868. 9/87.

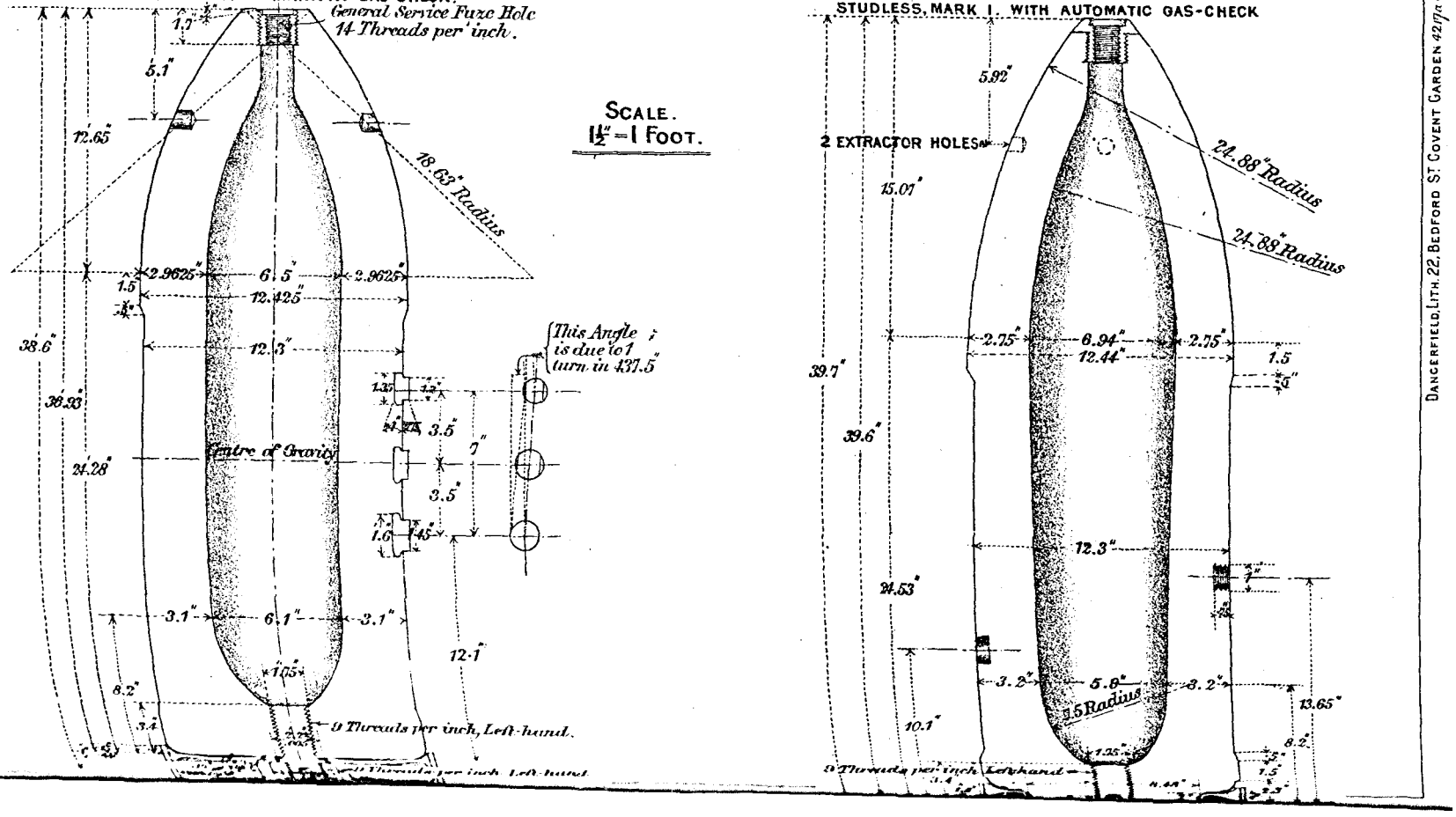
SKETCH SHEWING BLOCKS PACKING, FOR USE WITH REAR ROLLER JACKS, WHEN UNDER PRESSURE IN THE "FRAME STORE."



DANGERFIELD LITH. 22, BEDFORD ST COVENT GARDEN. 14868. 9/87.

Plate XV.

SHELL COMMON R.M.L. 12·5 INCH.

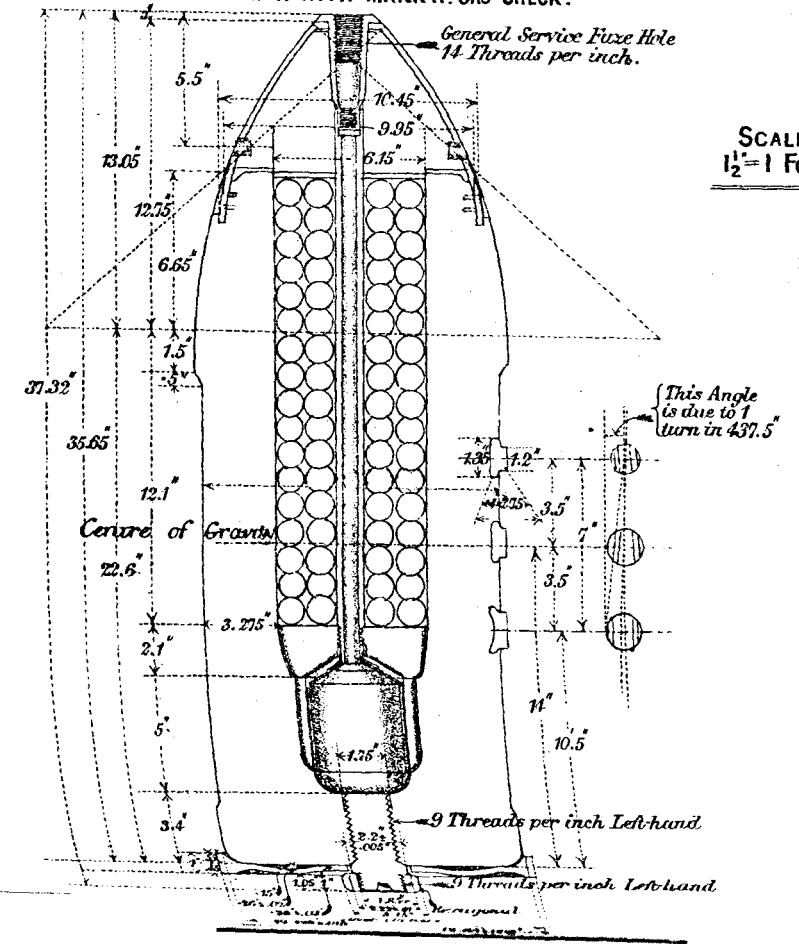


DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN 427a·1·88.

Plate XVI.

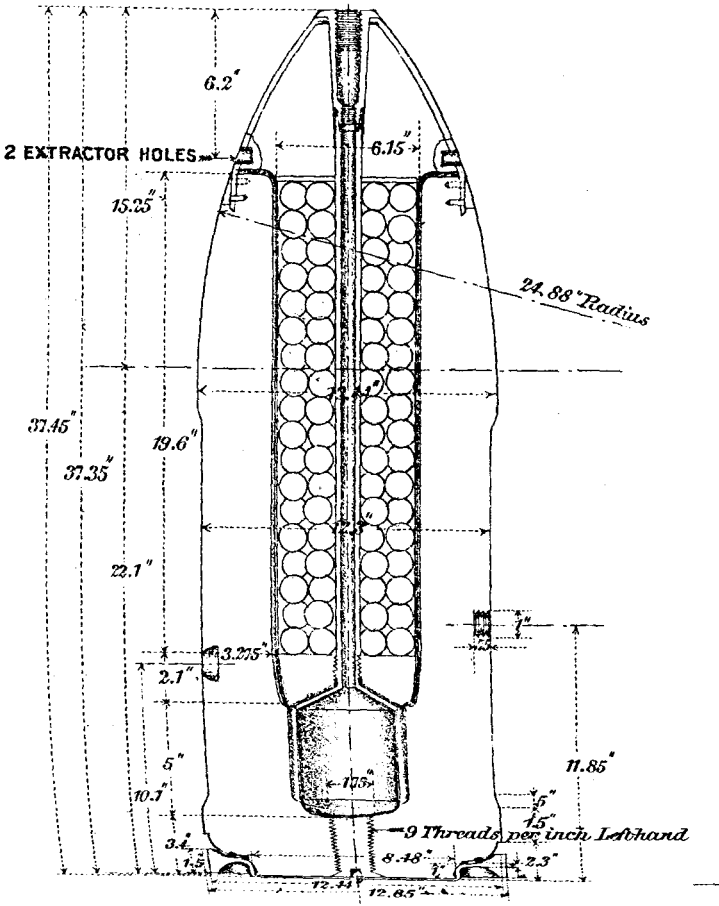
SHELL SHRAPNEL R.M.L. 12·5. INCH.

STUDDED MARK I. WITH MARK II. GAS-CHECK.



SCALE,
1½"=1 FOOT.

STUDLESS MARK I. WITH AUTOMATIC GAS-CHECK.

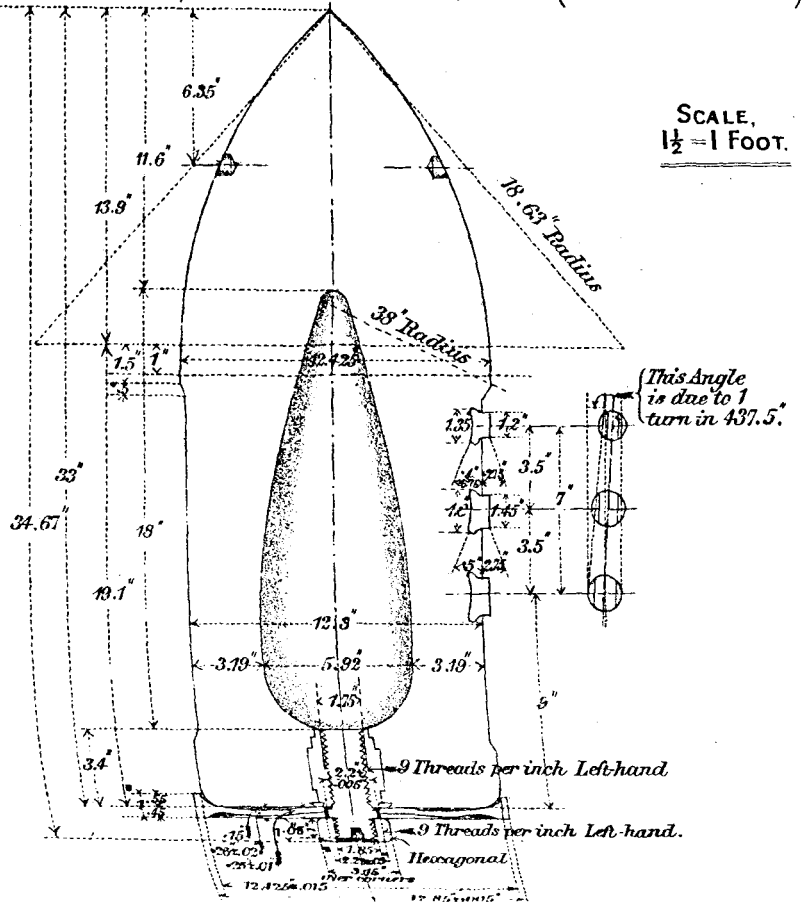


DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN. 42/7a.3/88

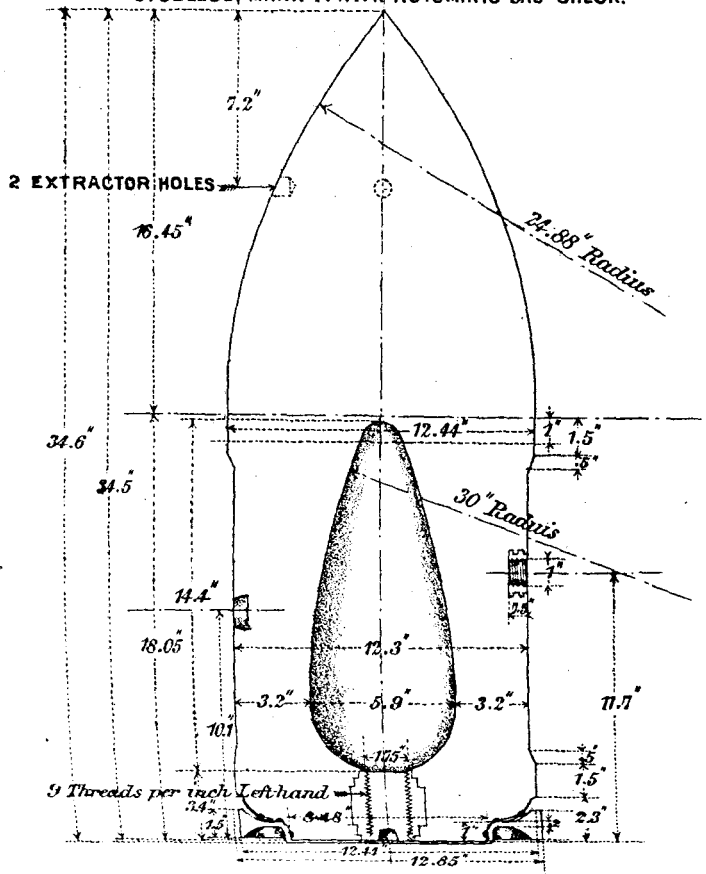
Plate XVII.

STUDDED, MARK III, WITH MARK II. GAS-CHECK. SHOT. (FORMERLY SHELL) PALLISER. R.M.L. 12·5 INCH.

SCALE, 1½ = 1 FOOT.



STUDLESS, MARK I. WITH AUTOMATIC GAS CHECK.

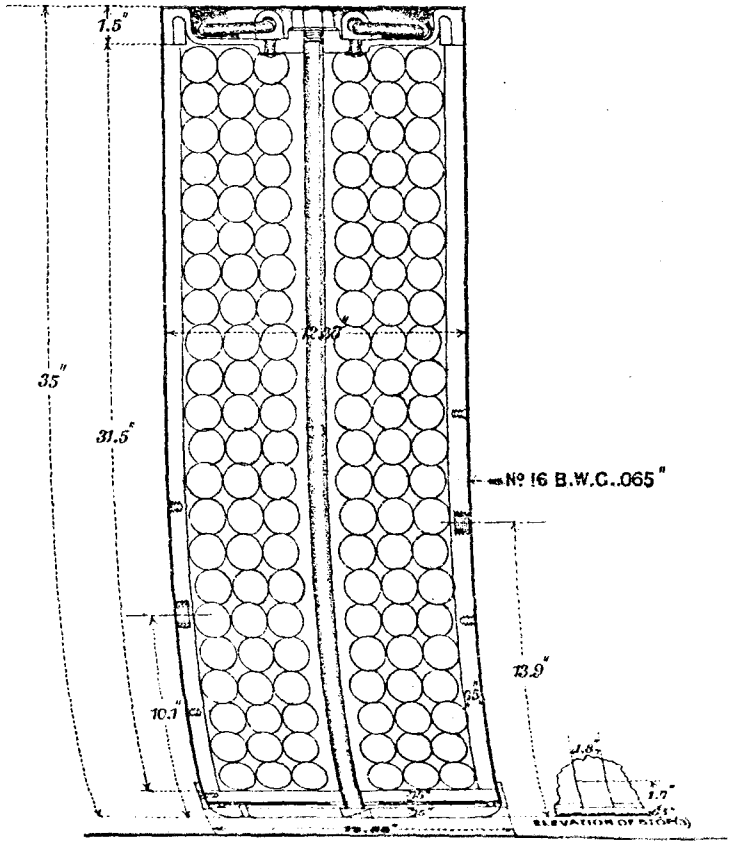


DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN. 422/a 3/88

Plate XVIII.

SHOT CASE 12.5 INCH. MARK III

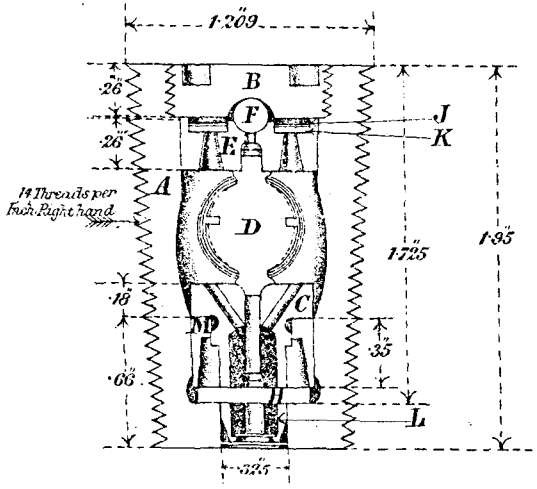
SCALE 1½" = 1 FOOT.



FUZE PERCUSSION PETTMAN GENERAL SERVICE. Nº 5.

MARK II.

FULL SIZE.

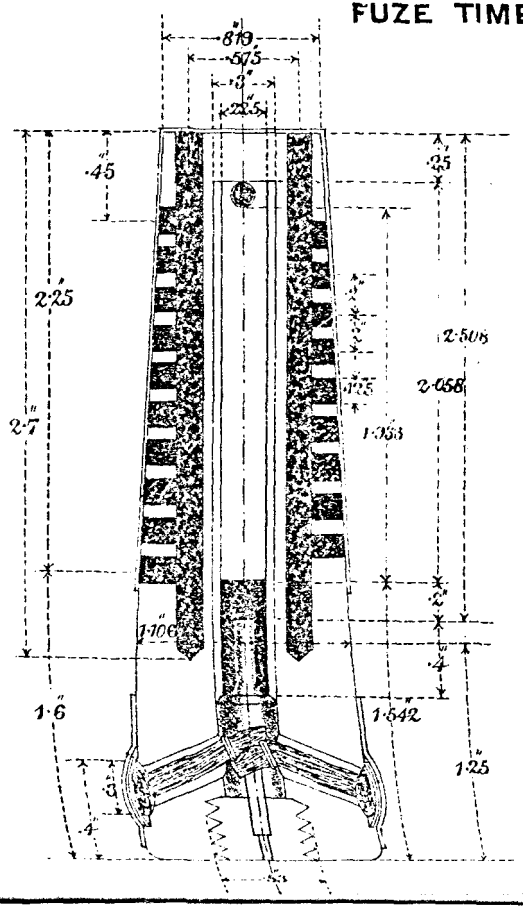


DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN. 421/a 5/88.

Plate XIX

FUZE TIME WOOD M.L. 15 SECONDS. Nº 41. MARK II.

Full size.



DEVELOPMENT OF PAPER SHOWING MARKING OF FUZE.

27·5	30	29·5	29	28·5	28
24·5	27	26·5	26	25·5	25
21·5	24	23·5	23	22·5	22
18·5	21	20·5	20	19·5	19
15·5	18	17·5	17	16·5	16
12·5	15	14·5	14	13·5	13
9·5	12	11·5	11	10·5	10
6·5	9	8·5	8	7·5	7
3·5	6	5·5	5	4·5	4
	3	2·5	2	1·5	1

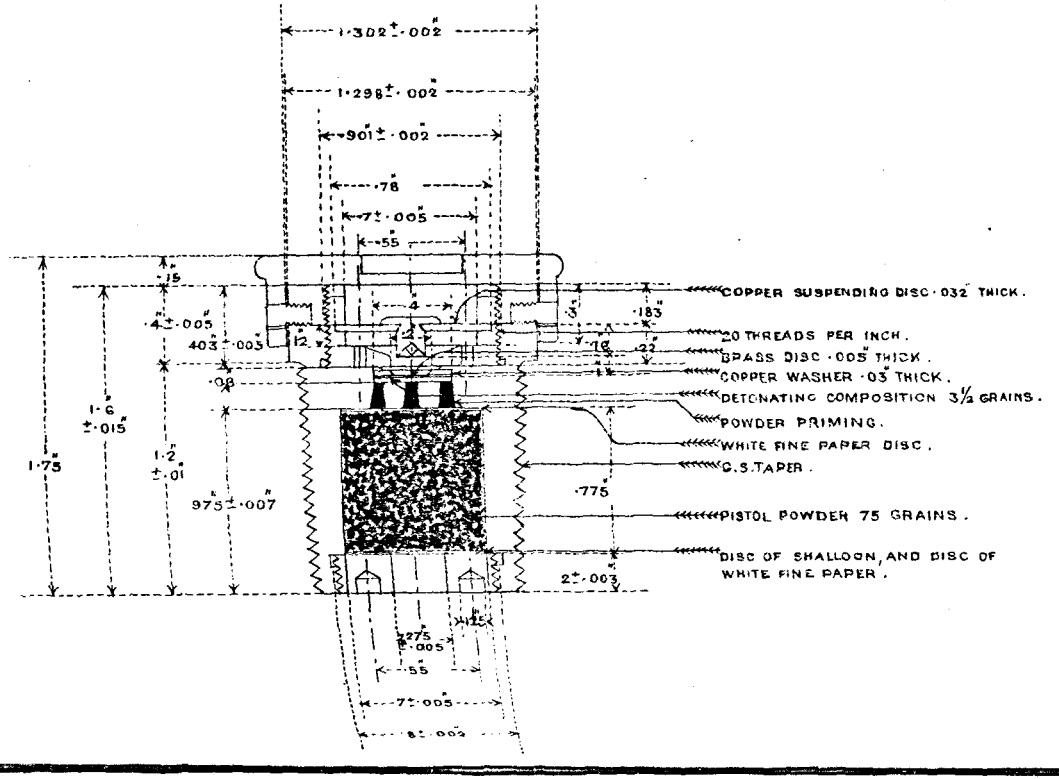
DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN. 15359. 3/88.

Plate XX.

FUZE PERCUSSION DIRECT ACTION Nº 3 MARK .II.

METAL 5 IN A TIN CYLINDER.

FULL SIZE

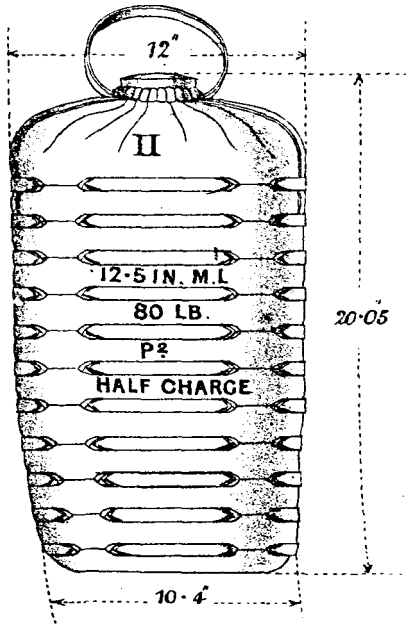


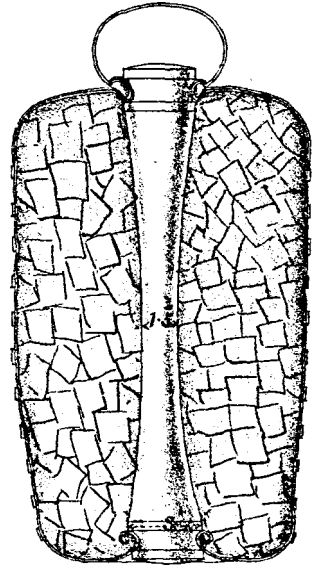
DANIELFIELD, LITH. 22 BEDFORD ST COVENT GARDEN. 15284. 11/87.

Plate XXI.

CARTRIDGE, SILK CLOTH, R. M. L. GUN, 12·5 INCH. MARK I. 80 LB. P². HALF CHARGE.

Scale 1½"=1 Foot.





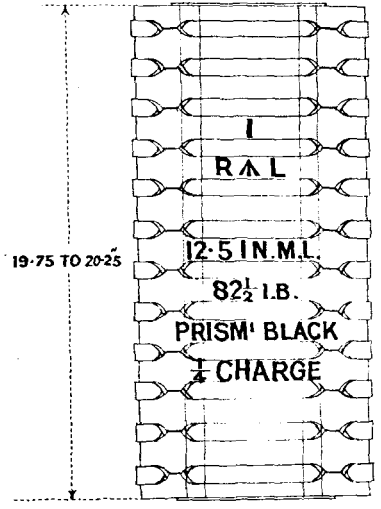
DANGERFIELD, LITH. 22, BEDFORD ST COVENT GARDEN 8206

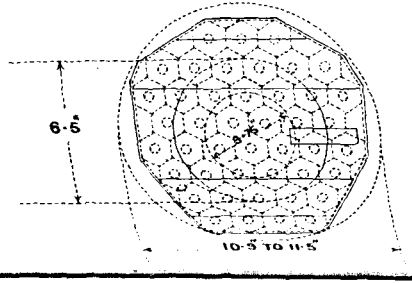
CARTRIDGE. R.M.L. SILK CLOTH. 12·5 INCH.

SCALE, $\frac{1}{8}$TH

82½ LB. PRISMᵗ BLACK. MARK I.

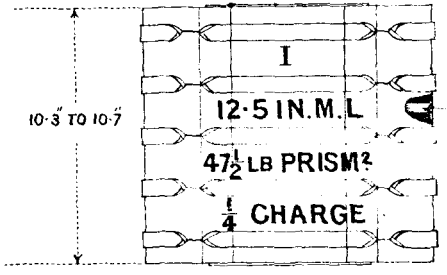
½ CHARGE FULL. MARK I. GUN.



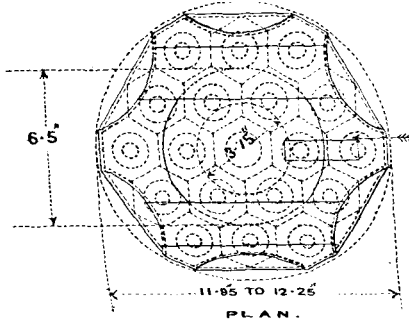


47½ LB. PRISMᵃ MARK I.

¼ CHARGE FULL MARK II GUN WITH DISC. LAND SERVICE


I
12·5 IN. M.L.
47½ LB PRISMᵃ
¼ CHARGE
10·3 TO 10·7
A PERFORATED WOOD DISC .3" THICK IS PLACED BETWEEN THE 2ND AND 3RD LAYERS OF PRISMS FROM THE TOP.

ELEVATION.



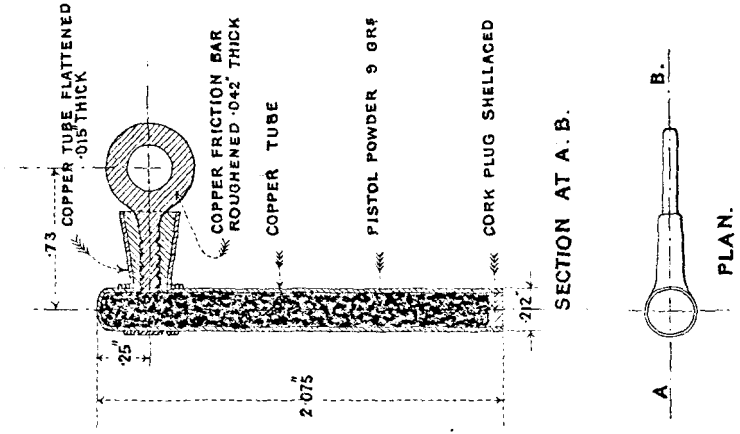
PLAN.

DANCKFIELD LITH 22, BEDFORD ST COVENT GARDEN 15959. 3/88

Plate XVIII.

TUBE FRICTION COPPER SOLID DRAWN. (MARK I.)

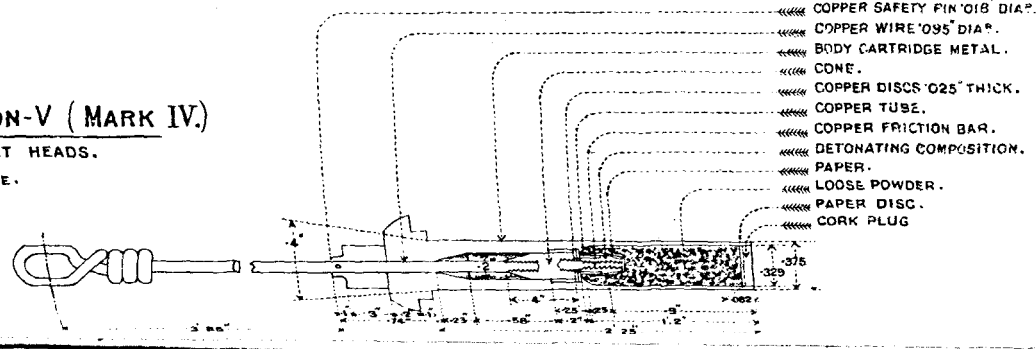
FULL SIZE.



TUBE VENT SEALING-FRICTION-V (MARK IV.)

BRASS FOR GUNS WITH VENT HEADS.

SCALE 3/4 FULL SIZE.

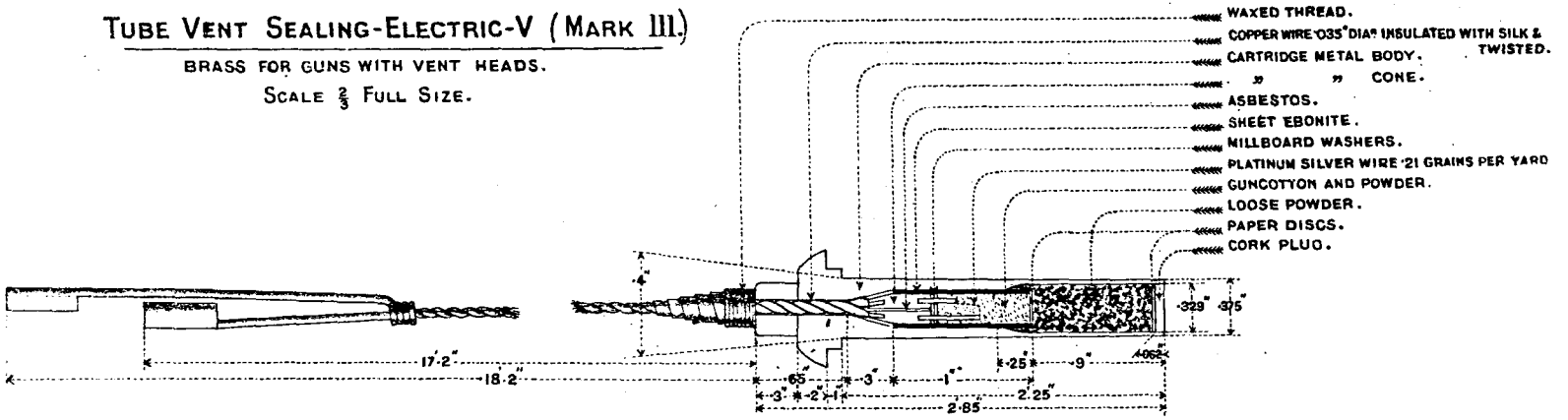


LANGFIELD LITH. 22, BEDFORD ST. COVENT GARDEN 16959/08

TUBE VENT SEALING-ELECTRIC-V (MARK III.)

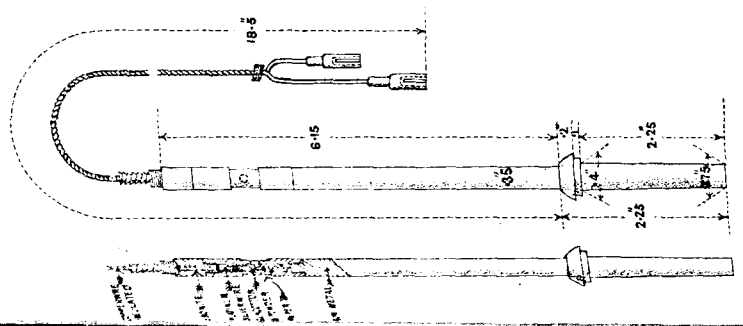
BRASS FOR GUNS WITH VENT HEADS.

SCALE ⅔ FULL SIZE.



TUBE VENT SEALING ELECTRIC V. DRILL. (MARK I.)

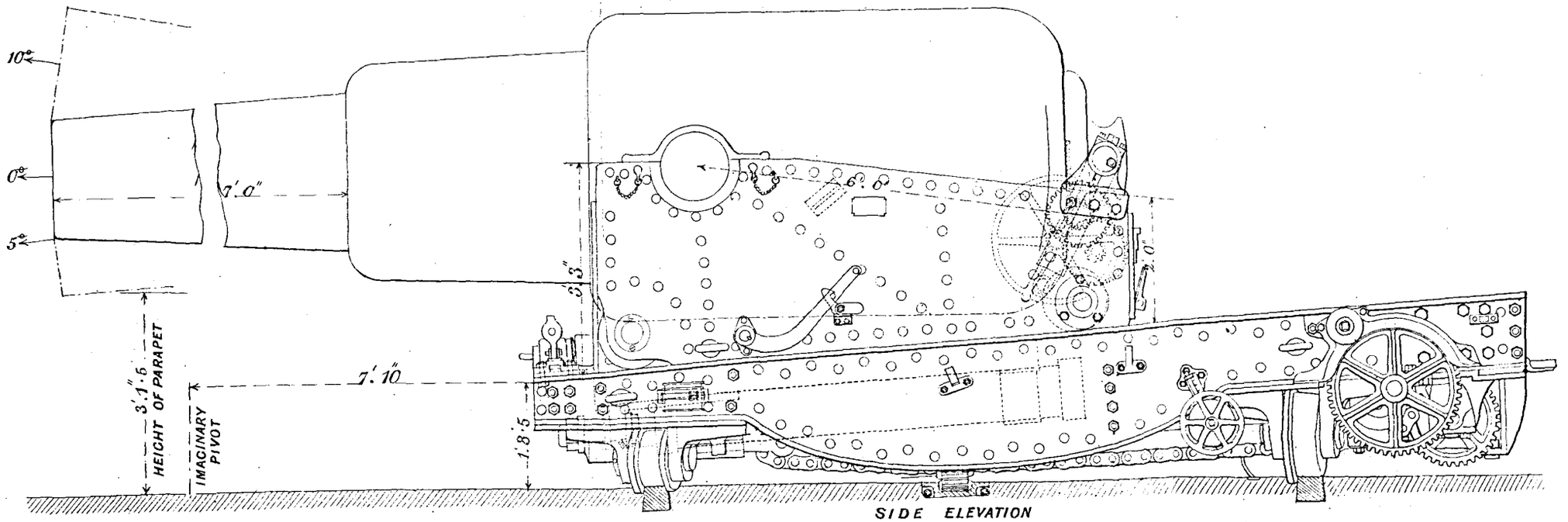
SCALE ½ FULL SIZE.



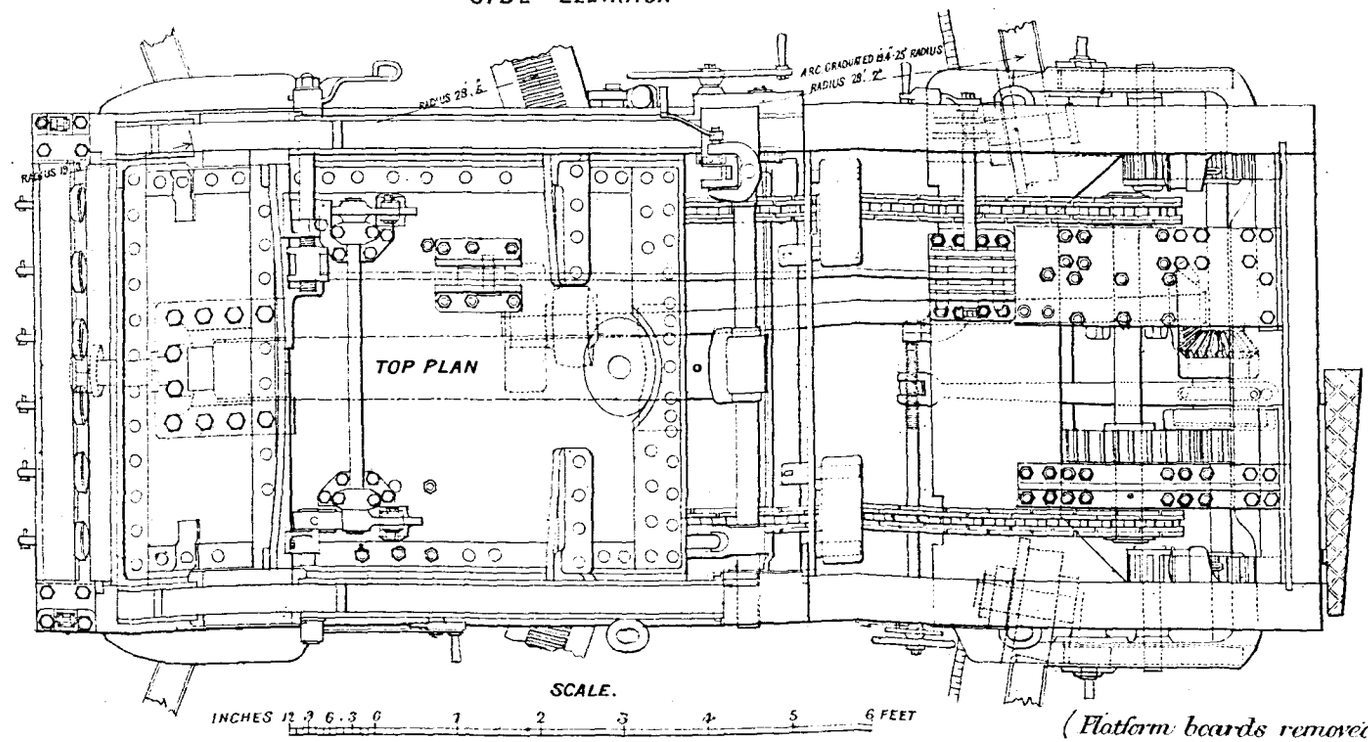
DARGERFIELD LITH. 22, BEDFORD ST. COVENT GARDEN. 15959 3/88.

CARRIAGE, CARRISON, R.M.L. 12·5 INCH, CASEMATE OR DWARF 6 FEET RECOIL MARK II.
PLATFORM R.M.L. 12·5 INCH. CASEMATE, 6 FEET RECOIL, MARK III.

Plate VI.



SIDE ELEVATION



SCALE.

INCHES 12 9 6 3 0 1 2 3 4 5 6 FEET

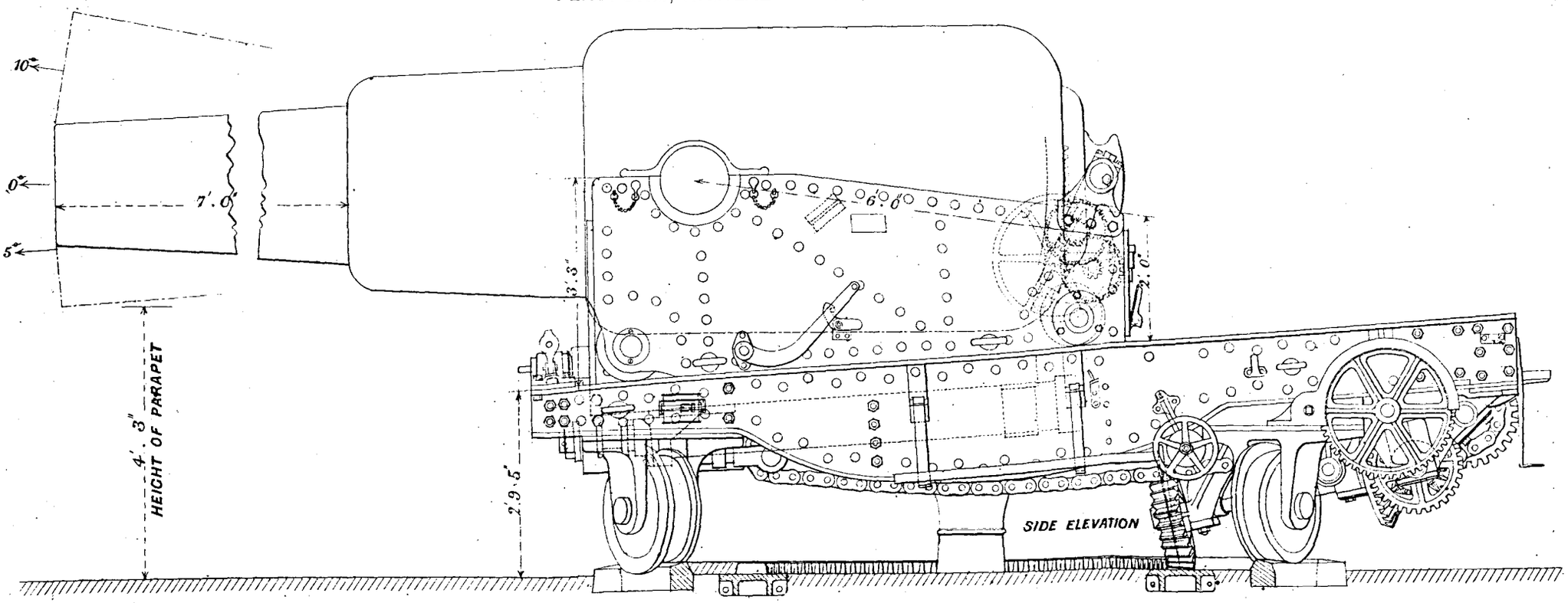
(Platform boards removed.)

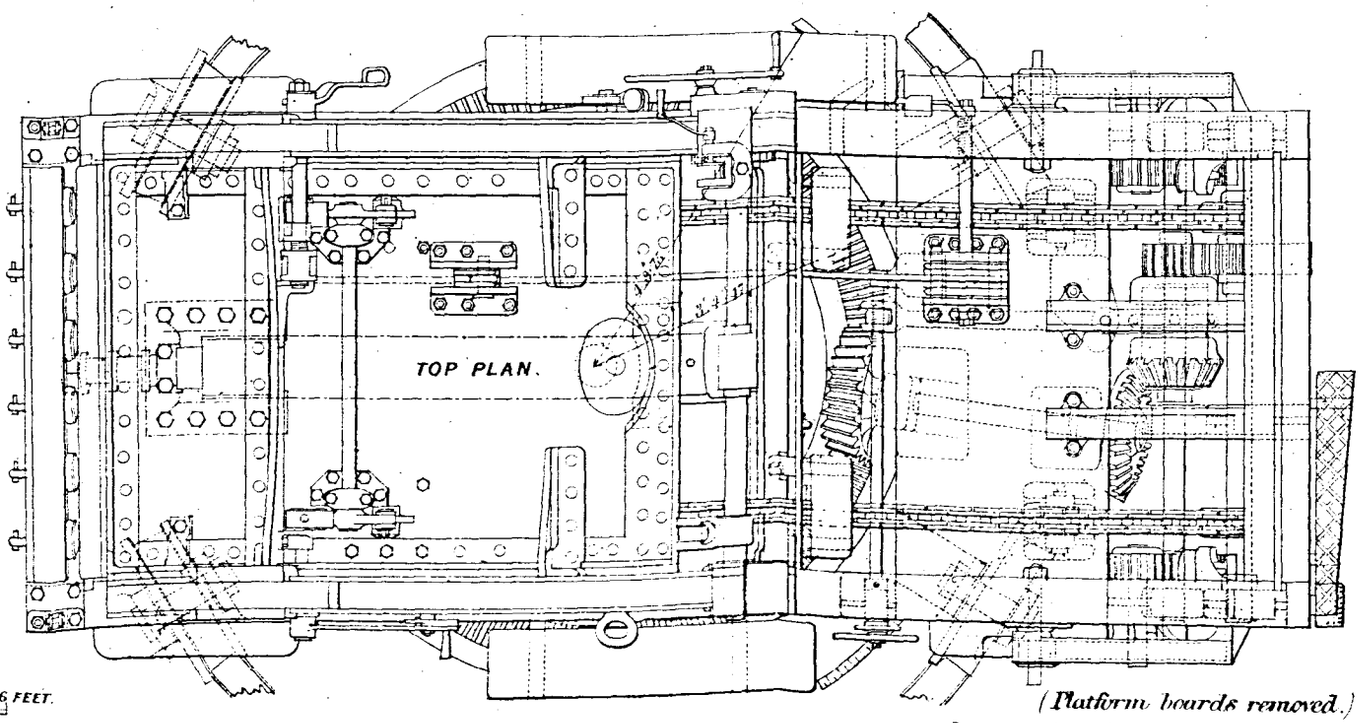
DANCERFIELD LITH 22 BEDFORD ST COVENT GARDEN 8484. 10/84

CARRIAGE, GARRISON, R.M.L. 12·5 INCH CASEMATE OR DWARF, 6 FEET RECOIL MARK II.

PLATFORM, R.M.L. 12·5 INCH, DWARF "C" MARK III.

Plate VII.





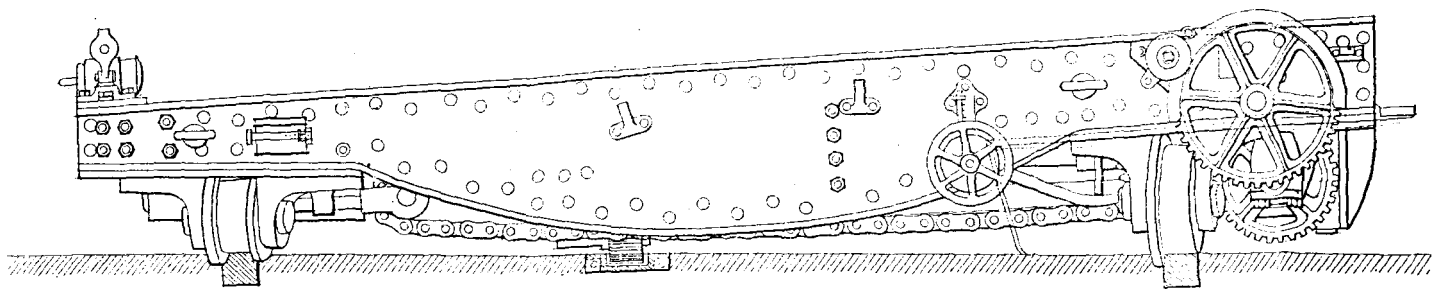
(Platform boards removed.)

SCALE.

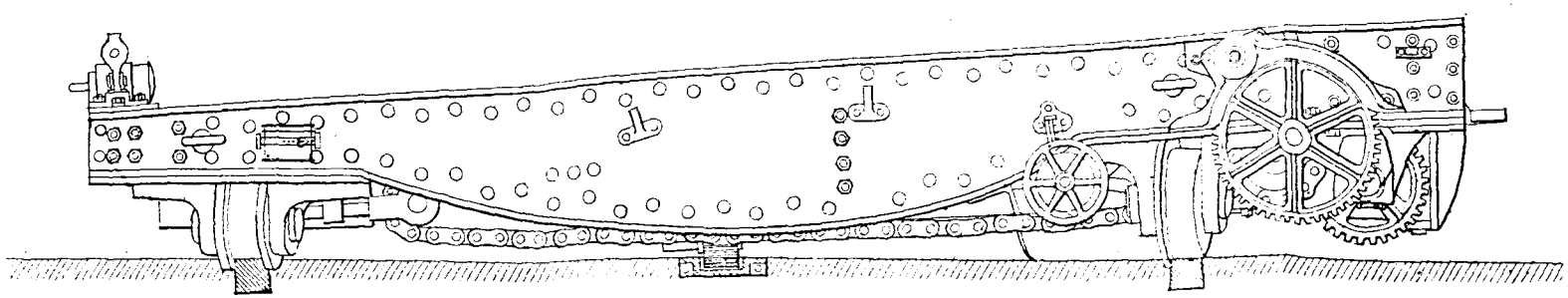
INCHES 12 9 6 3 0 1 2 3 4 5 6 FEET.

DANGERFIELD LITH. 22 BEDFORD ST. COVENT GARDEN 8484. 10/84.

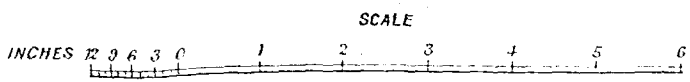
PLATFORM, R.M.L. 12·5 INCH CASEMATE. 6 FEET RECOIL, MARK III SPECIAL.



PLATFORM, R.M.L. 12·5 INCH. CASEMATE 7 FEET RECOIL, MARK III.

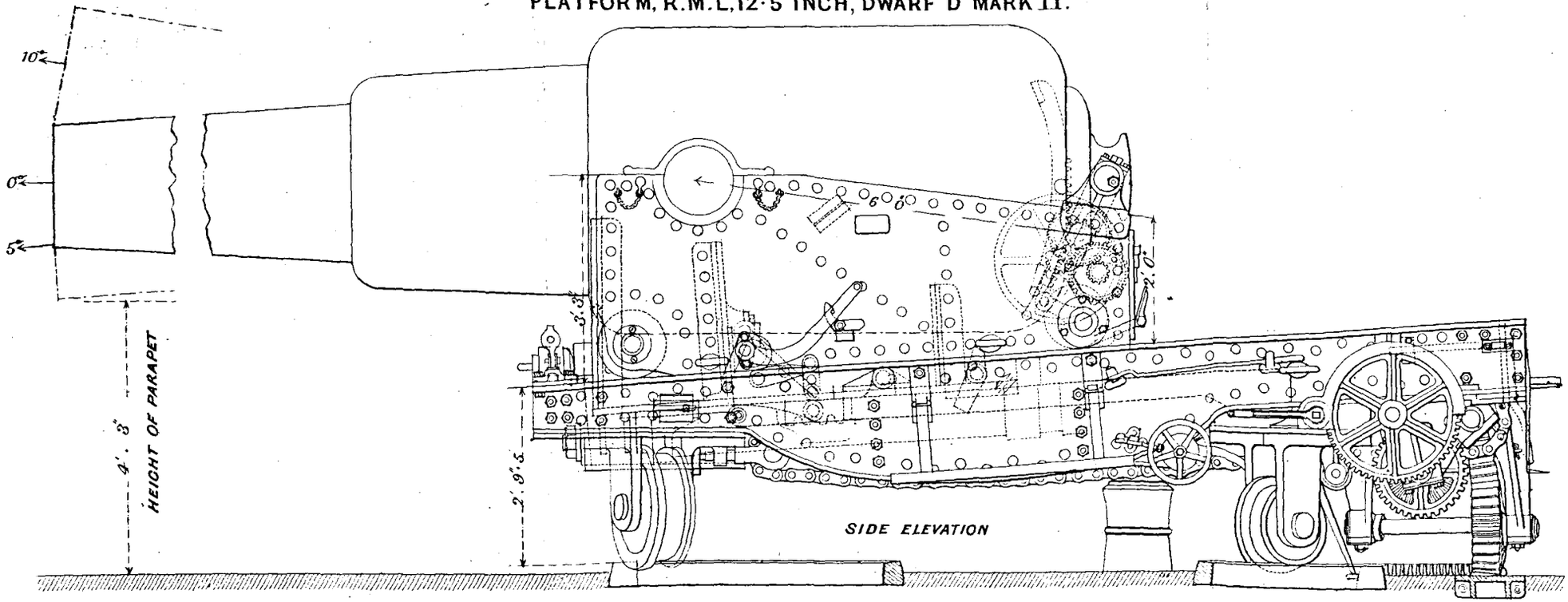


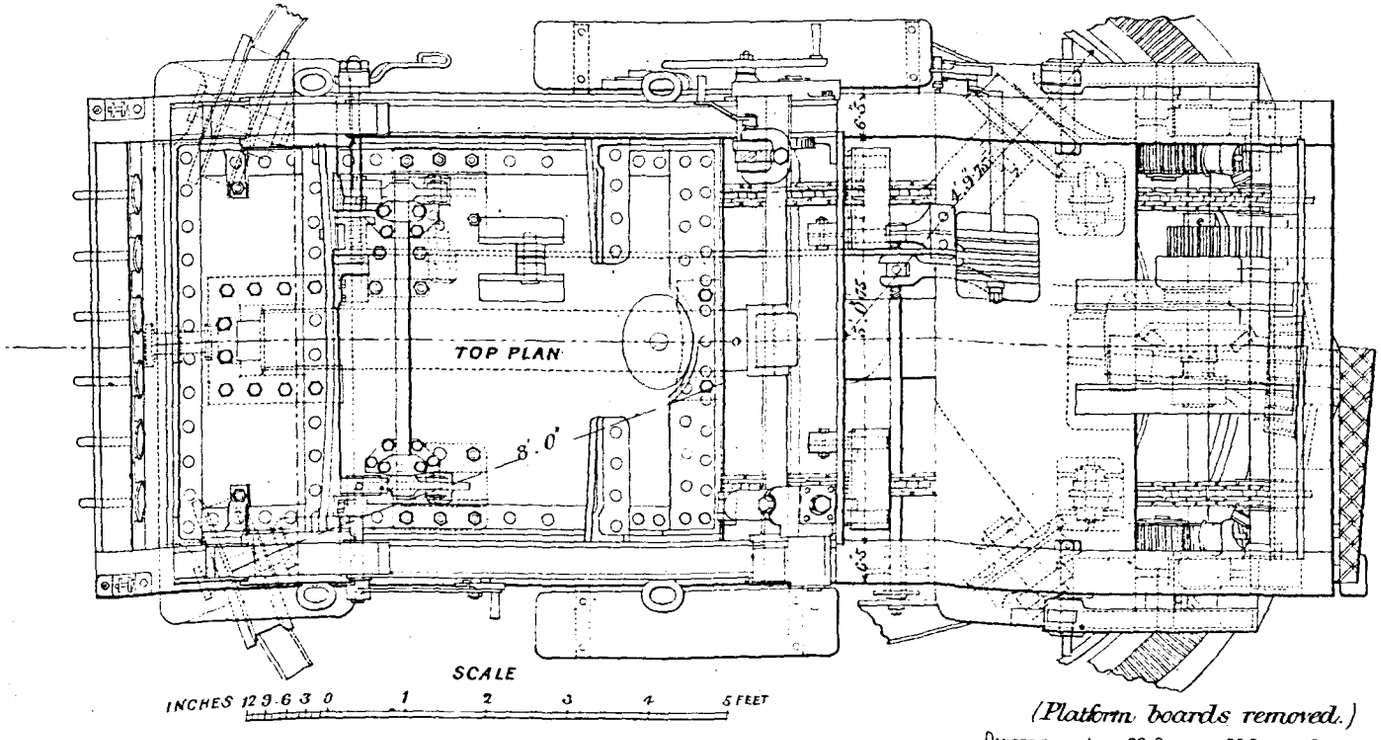
SCALE



Dangerfield Lith 22 Bedford St Covent Garden 84.94. 10/84

CARRIAGE, GARRISON, R.M.L. 12·5 INCH, CASEMATE OR DWARF, 6 FEET RECOIL, MARK II.
PLATFORM, R.M.L, 12·5 INCH, DWARF "D" MARK II.

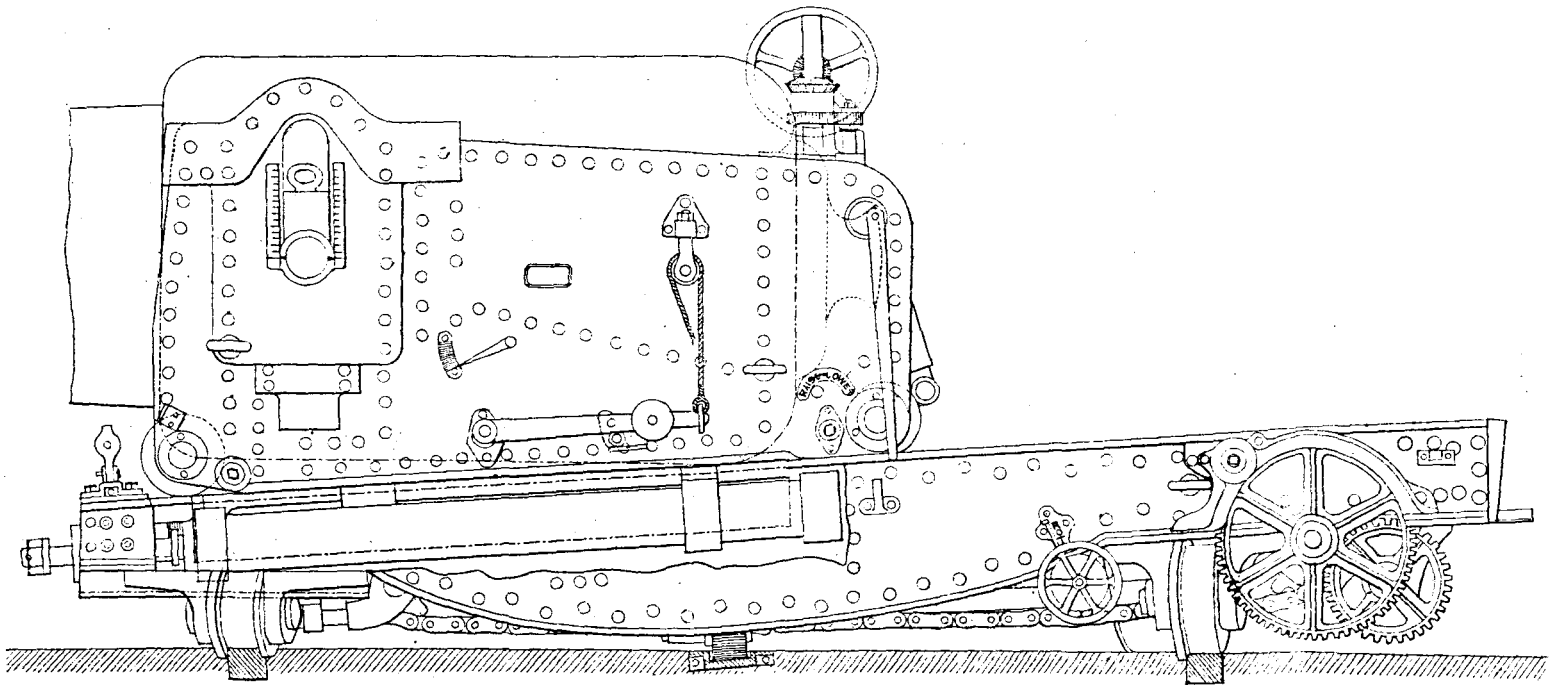


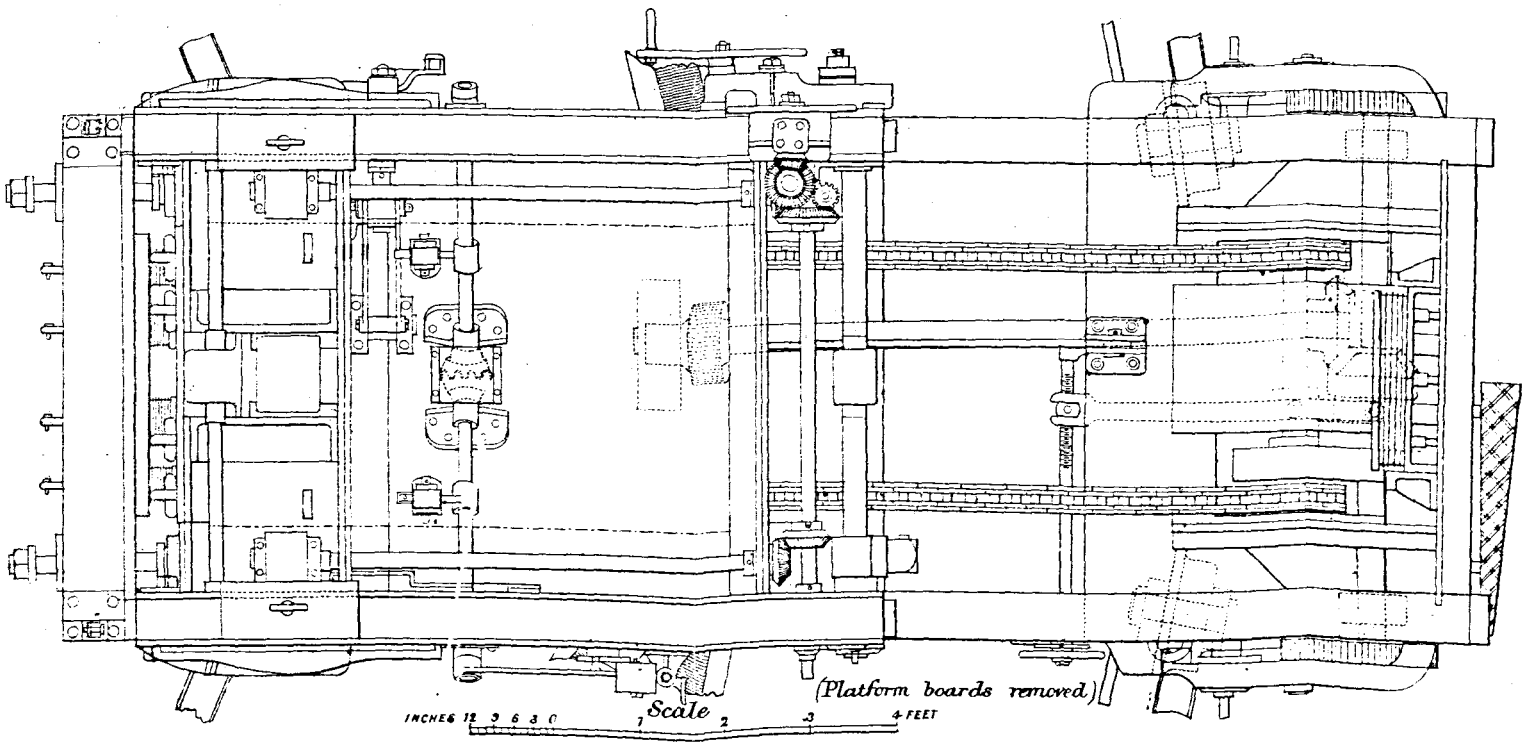


(Platform boards removed.)

DANGERFIELD LITH. 22, BEDFORD ST COVENT GARDEN. 8484. 10/84.

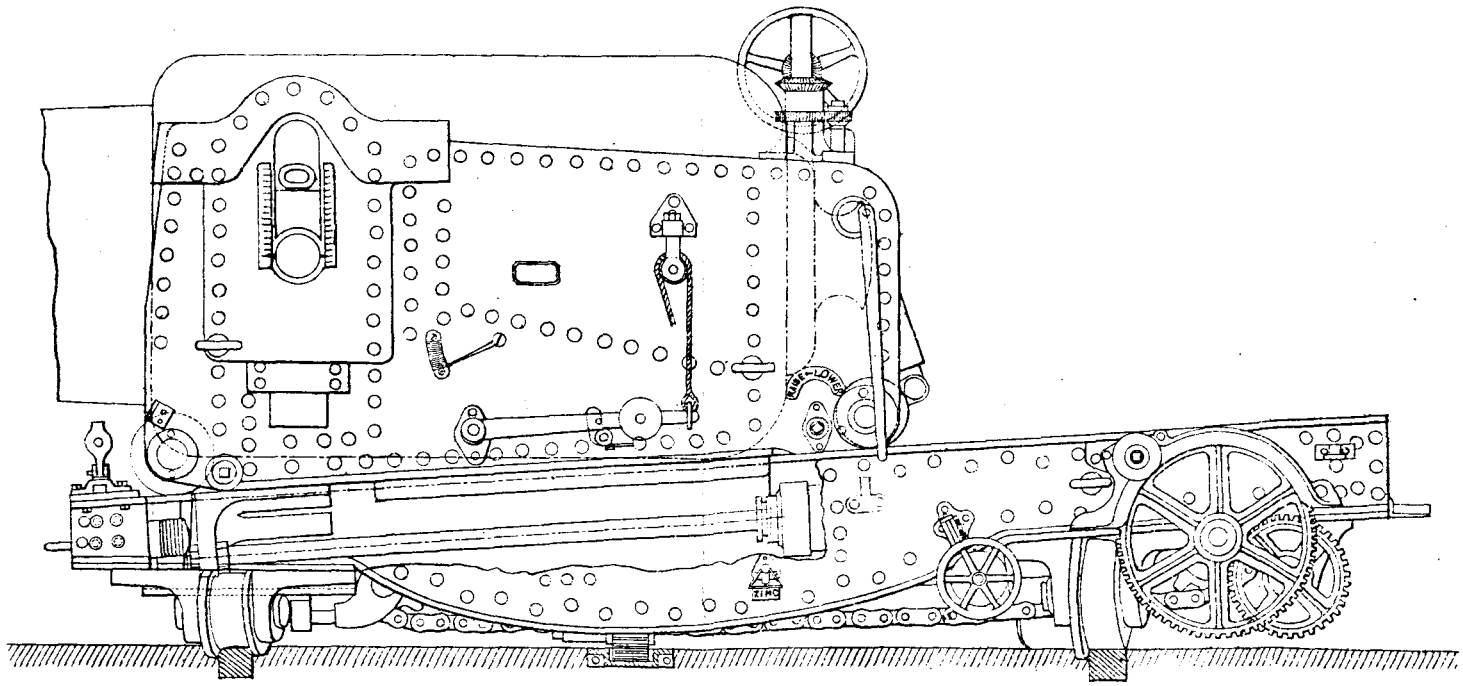
CARRIAGE CARRISON R.M.L. 12·5 INCH, SMALL PORT 7 FEET RECOIL, MARK I.
PLATFORM, R.M.L. 12·5 INCH, SMALL PORT, 7 FEET RECOIL, MARK I.

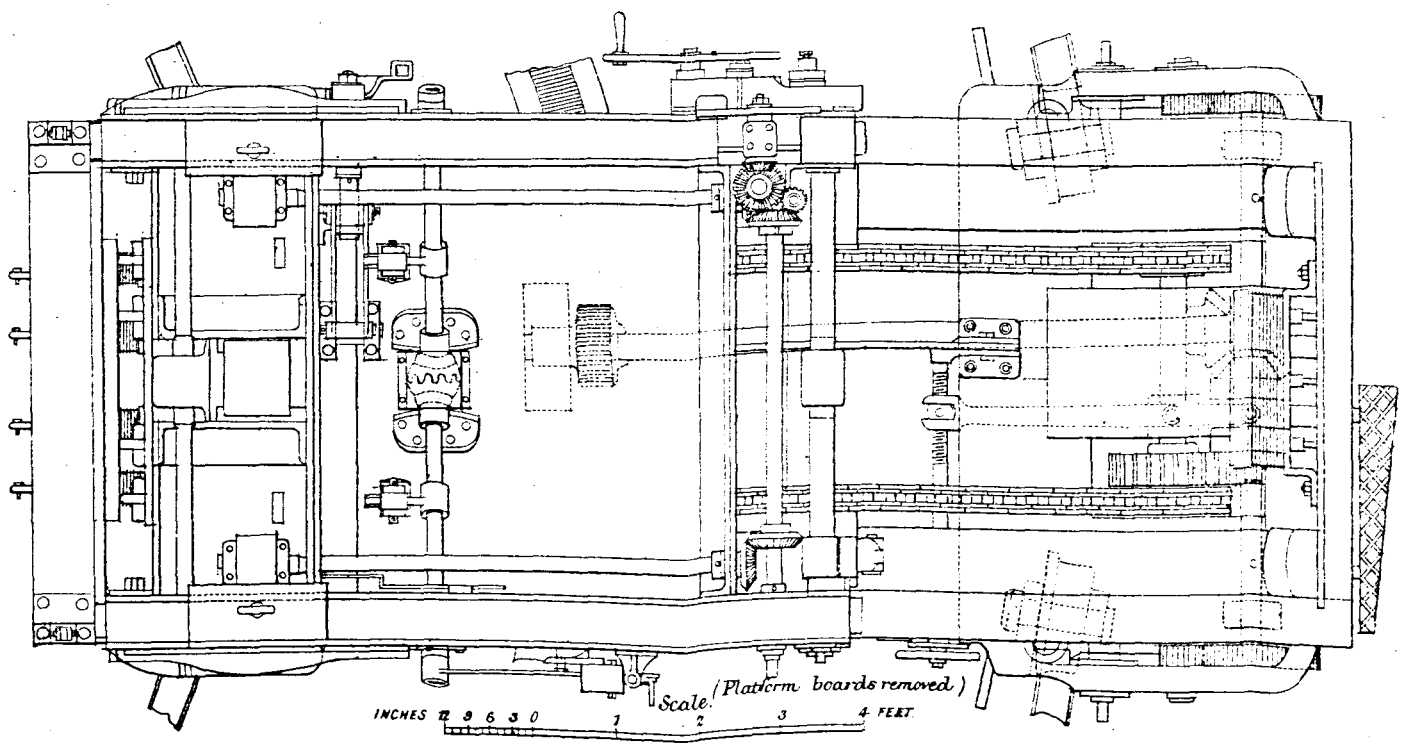




DANGERFIELD, LITH 22, BEDFORD ST COVENT GARDEN 8206

CARRIAGE, CARRISON, R.M.L 12·5 INCH, SMALL PORT, 6 FEET RECOIL MARK I.
PLATFORM. R.M.L. 12·5 INCH, SMALL PORT, 6 FEET RECOIL, MARKS II AND III.



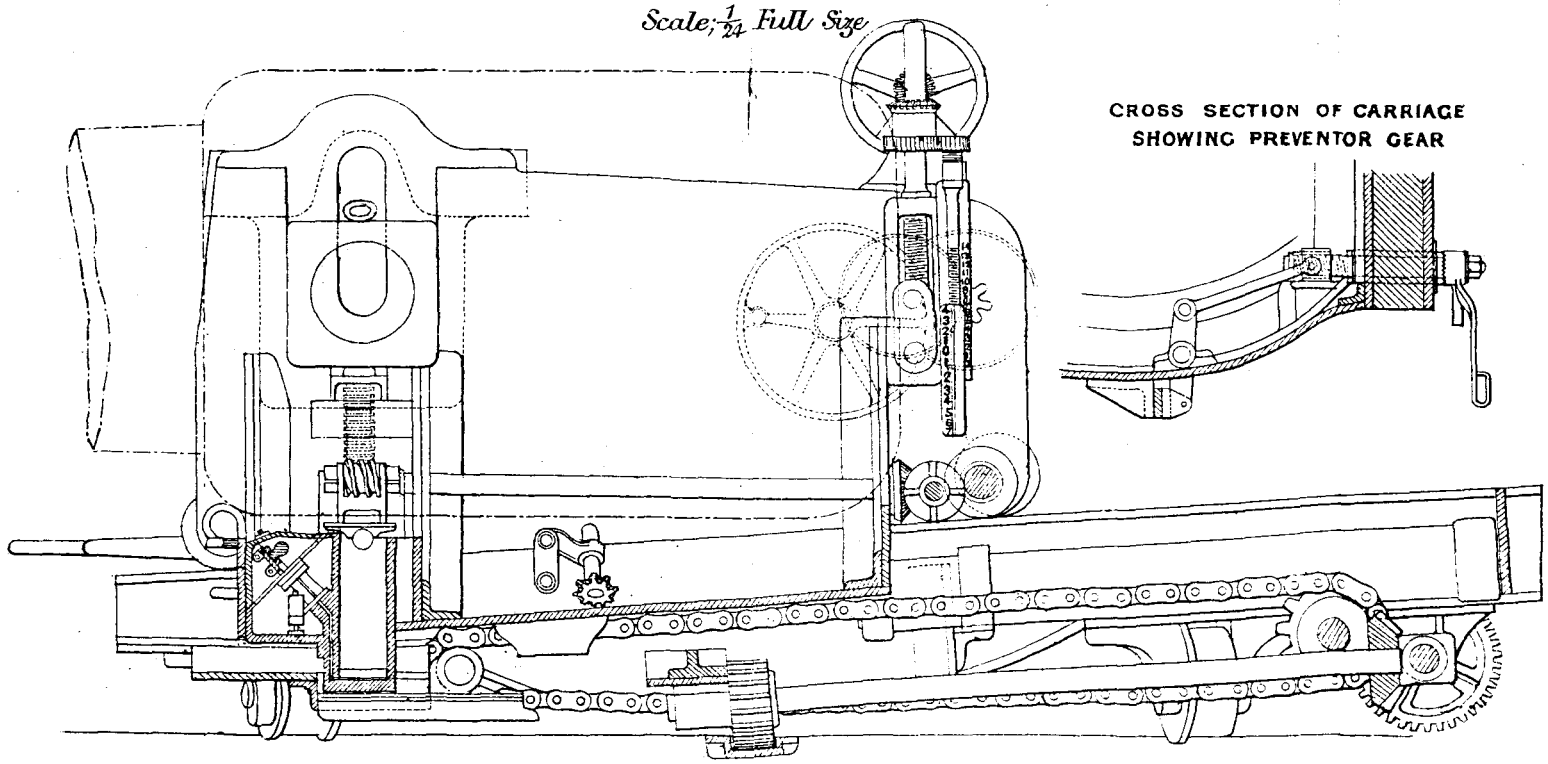


DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN. 8206.

CARRIAGE CARRISON, R.M.L. 12·5 INCH, SMALL PORT, 6 FEET RECOIL
PLATFORM. R.M.L, 12·5 INCH, SMALL PORT 6 FEET, RECOIL. MARKS II AND III

LONGITUDINAL SECTION THROUGH CENTRE LINE.

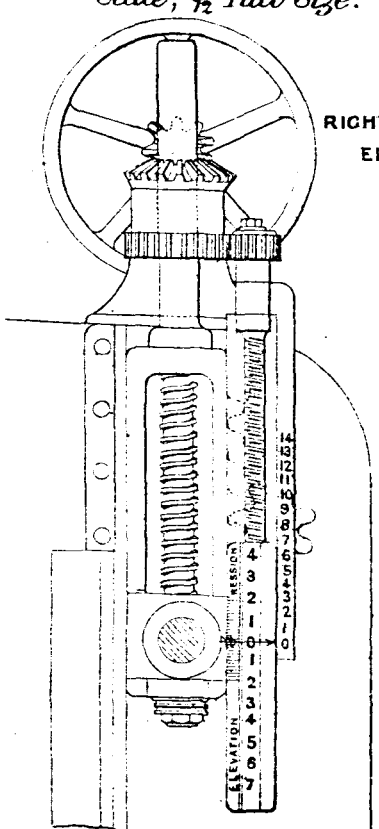
Scale; 1/24 Full Size



CROSS SECTION OF CARRIAGE
SHOWING PREVENTOR GEAR

Scale; ½ Full Size.

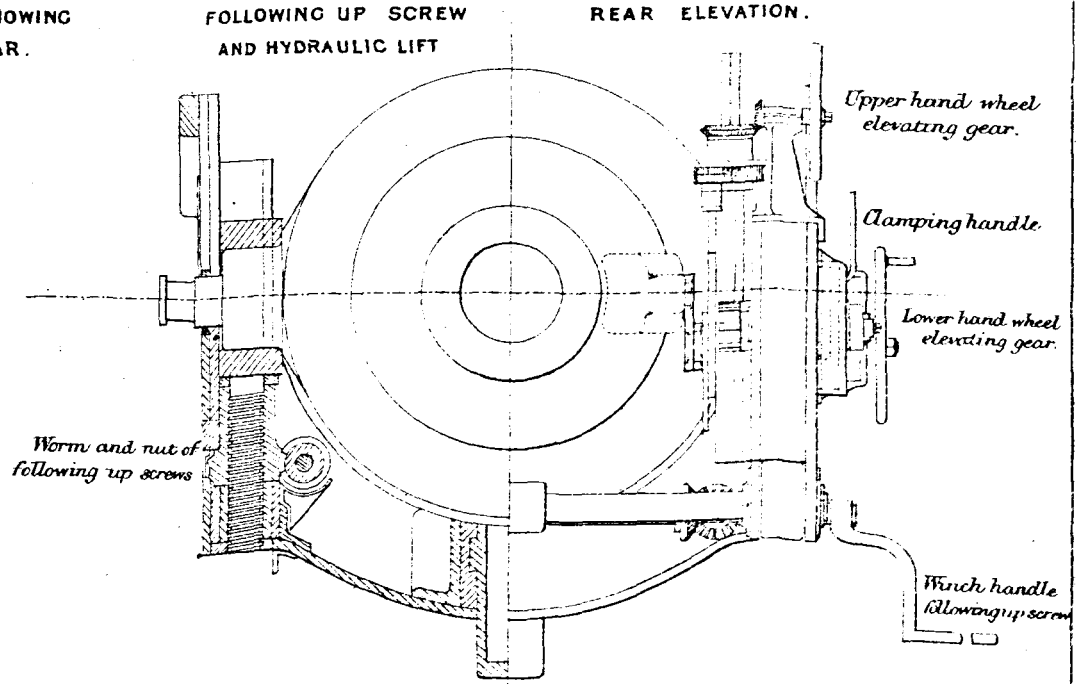
INSIDE OF
RIGHT BRACKET SHOWING
ELEVATING GEAR.



Scale 1/24 Full Size.

SECTION THROUGH
FOLLOWING UP SCREW
AND HYDRAULIC LIFT

REAR ELEVATION.


Upper hand wheel elevating gear.
Clamping handle.
Lower hand wheel elevating gear.
Worm and nut of following up screws
Winch handle following up screw

DANGERFIELD LITH. 22, BEDFORD ST. COVENT GARDEN. 8206